moray offshore renewables ltd

Environmental Statement

Technical Appendix 5.2 E - Navigational Risk Assessment (OfTI)

Telford, Stevenson, MacColl Wind Farms and associated Transmission Infrastructure Environmental Statement

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This study has been carried out by Anatec Ltd (Anatec) on behalf of Moray Offshore Renewables Limited (MORL). The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

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1. INTRODUCTION

1.1 Background

Anatec was commissioned by MORL to perform a shipping and navigation assessment of the offshore export cable route from the Eastern Development Area (EDA), located in the Moray Firth, off the coastline of Caithness to a landfall on the North East Coast of Scotland (near Fraserburgh/Peterhead).

MORL intend to apply for the consent required for the offshore transmission infrastructure (OfTI), with assets likely to be transferred to an OFTO (Offshore Transmission Operator) for construction, operation and decommissioning.

It should be noted that the OFTO infrastructure planning is at an early stage, and therefore many aspects of the design are yet to be finalised. The report presents information on the export cable route at the time of writing relative to the baseline marine activity and navigational features for the area.

1.2 Study Scope

The main part of the assessment considers the export cable route associated with the following maritime activities:

- Commercial Shipping
- Recreational Sailing
- Fishing

In addition to these activities, consideration is given to the following:

- Navigational Features and Nearby Ports/Harbours
- Military Exercise Areas
- Marine Incidents
- Electromagnetic interference on shipborne navigational equipment

1.3 Data Sources

The main data sources used in this assessment are listed below:

- Ivero Shipping Survey AIS data July to October 2011;
- UK Coastal Atlas of Recreational Boating;
- UK Admiralty Charts;
- Marine Incident Data – Marine Accident and Investigation Branch (MAIB) 2001-10 and Royal National Lifeboat Institute (RNLI) 2001-10);
- Admiralty Sailing Directions (NP 52 / NP 54); and
- Fishing Vessel Monitoring Satellite (VMS) (2009) and Overflight data (2005-09).

1.4 Abbreviations

The following abbreviations are used in this report:

AC	-	Alternating Current
AIS	-	Automatic Identification System
ALB	-	All-Weather Lifeboat
AtoN	-	Aid to Navigation
CA	-	Cruising Association
DECC	-	Department of Energy and Climate Change
DfT	-	Department for Transport
EDA	-	Eastern Development Area
ES	-	Environmental Statement
HAT	-	Highest Astronomical Tide
ILB	-	Inshore Lifeboat
ICES	-	International Council for the Exploration of the Seas
IMO	-	International Maritime Organisation
HVDC	-	High Voltage Direct Current
KIS-CA	-	Kingfisher information Services – Cable Awareness
km	-	Kilometre
LAT	-	Lowest Astronomical Tide
LNG	-	Liquid Nitrogen Gas
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MMO	-	Marine Management Organisation
MORL	-	Moray Offshore Renewables Limited
MW	-	Mega-Watt
nm	-	Nautical Miles
OFTO	-	Offshore Transmission Operator
OREI	-	Offshore Renewable Energy Installations
PEXA	-	Practice and Exercise Area
PLN	-	Port Letter Number
RAF	-	Royal Air Force
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SFI	-	Sea Fisheries Inspectorate
SHETL	-	Scottish Hydro Electric Transmission Limited
UKCS	-	United Kingdom Continental Shelf
UKHO	-	United Kingdom Hydrographic Office
VMS	-	Vessel Monitoring Service

2. WIND FARM DETAILS

2.1 Introduction

This section presents details on the proposed three wind farm sites and offshore export cable route which is located in the outer Moray Firth.

2.2 Wind Farm Boundary

The EDA is located approximately 12nm east by south east of Sarclet Head (4nm south of Wick) and 23nm north of Buckie. The corner coordinates of the EDA are presented in Table 2.1.

Table 2.1 Co-ordinates of EDA Boundary

Corner	Latitude	Longitude
Northern Point (A)	58° 19' 24.89" N	002° 44' 21.35" W
South western Point (C)	58° 03' 52.52" N	002° 54' 59.21" W
Eastern Point (B)	58° 08' 04.80" N	002° 34' 11.01" W
North western Point (D)	58° 12' 35.11" N	002° 52' 28.42" W

A chart of the site boundary and corner points is presented in Figure 2.1.

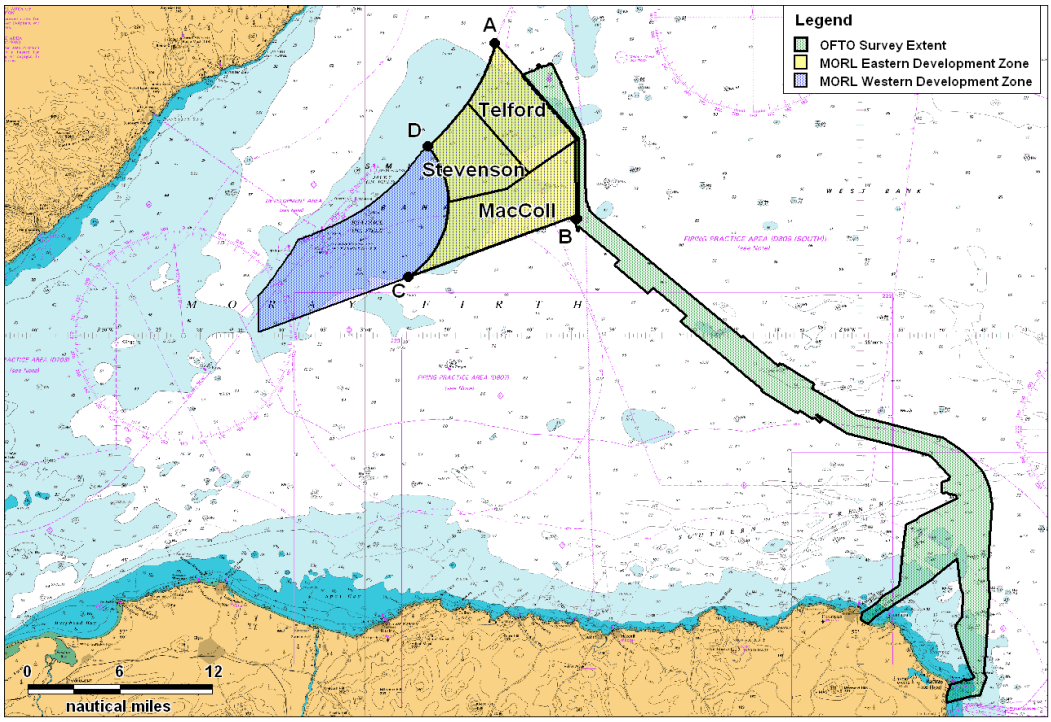

Figure 2.1 Chart Overview of EDA and Cable Route

2.3 Offshore Cable Routes

A detailed plot of the northern section of the offshore export cable route corridor is presented in Figure 2.2. It is noted that both the Fraserburgh Bay and Peterhead options follow the same route on the northern section of the export cable route.

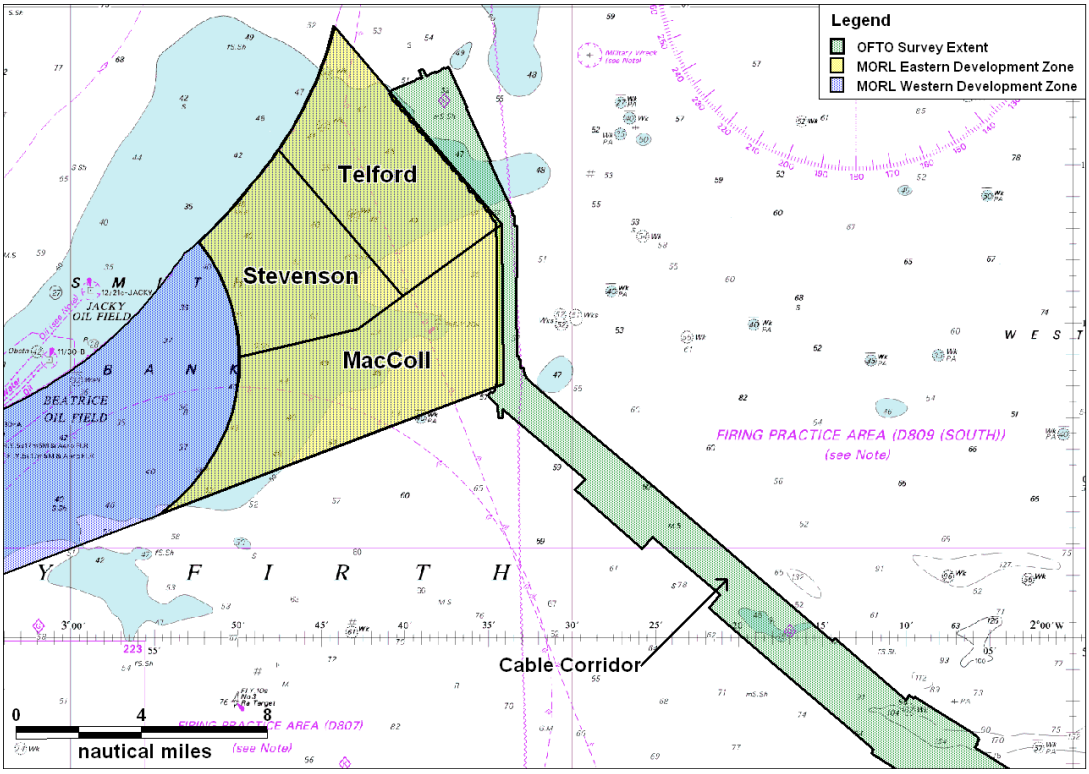

Figure 2.2 Detailed Chart of the Northern Section of the Cable Route

Figure 2.3 presents a detailed chart of the southern section of the cable route and landfall options.

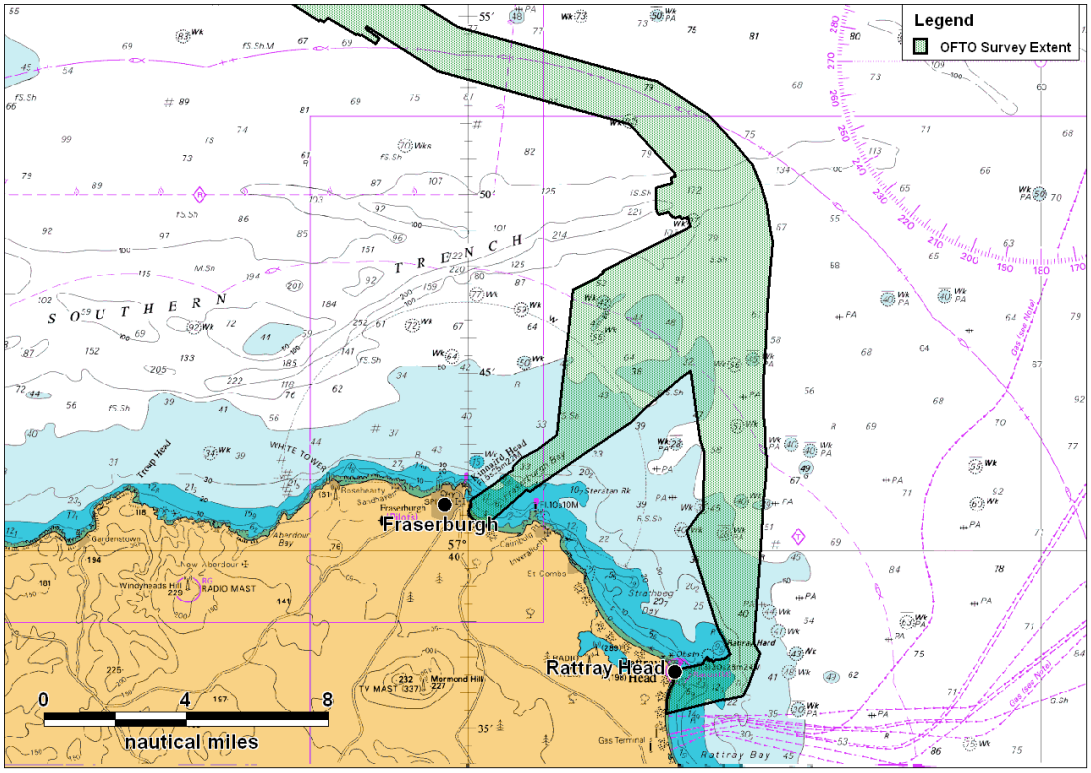

Figure 2.3 Detailed Southern Cable Route and Landfall

The offshore export cable route runs for approximately 46nm south and east from the three proposed wind farms, where the cable route has two landfall options.

The two landfall options are separated by 7.7nm (overland), with the landfall route at Fraserburgh Bay running for 8nm from the main cable route and the Rattray Head option making landfall approximately 12nm south.

3. EXISTING ENVIRONMENT

3.1 Introduction

This section presents the following baseline information relating to navigation in the outer Moray Firth and adjacent to the offshore export cable route from the three wind farms proposed within the EDA:

- Ports
- Navigational Features
- Exercise Areas

3.2 Ports and Anchorage

A chart of nearby ports, harbours and anchorage areas relative to the cable route extracted from the Admiralty Sailing Directions for the area (Ref. i) is presented in Figure 3.1.

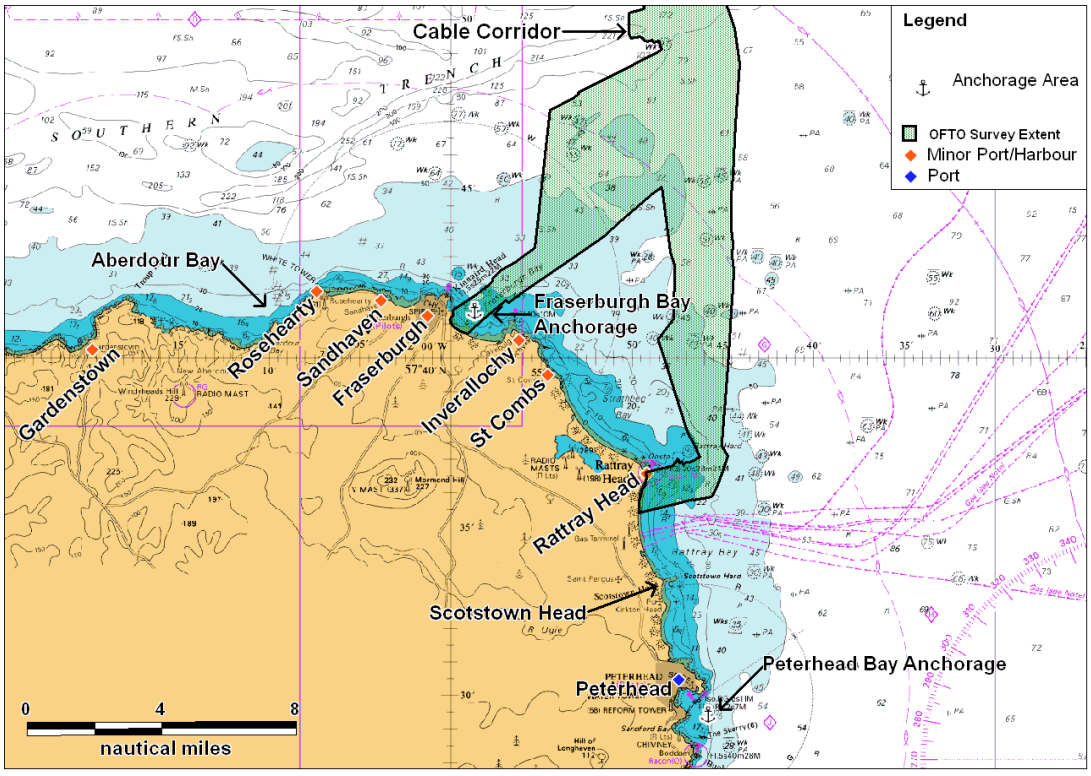

Figure 3.1 Detailed Plot of Moray Firth Ports and Harbours

Fraserburgh Bay and Peterhead Bay are the two main anchorages recommended by the pilot books for the area:

- Peterhead Bay – offers an anchorage in depths up to 12.5m. The best holding ground is under the lee of the South Breakwater consisting of fine sand over blue clay or mud with occasional boulders; and

- Fraserburgh Bay – outer anchorage, vessels can anchor in Fraserburgh Bay east of the

harbour entrance. A good berth is in depths of 11m, approximately 1.2km east of the harbour entrance. Larger vessels can anchor about 330m further north in 14 to 15m. The bottom in these berths is sand over rock and in bad weather vessels in Fraserburgh Bay have been known to drag their anchors.

It is noted that vessels can anchor in other sheltered bays along the Aberdeenshire and Moray coastlines which are not charted or described in pilot books, the nearest anchorage to the offshore export cable route options is in Aberdour Bay approximately 6nm west of the Fraserburgh Bay landfall.

An analysis of vessels anchoring in the vicinity of the offshore export cable route based on survey data for the area is presented in Section 5.4.

3.3 Navigational Features

A plot of the navigational features relative to the northern and southern (landfall) sections of the export cable routeis presented in Figure 3.2 and Figure 3.3.

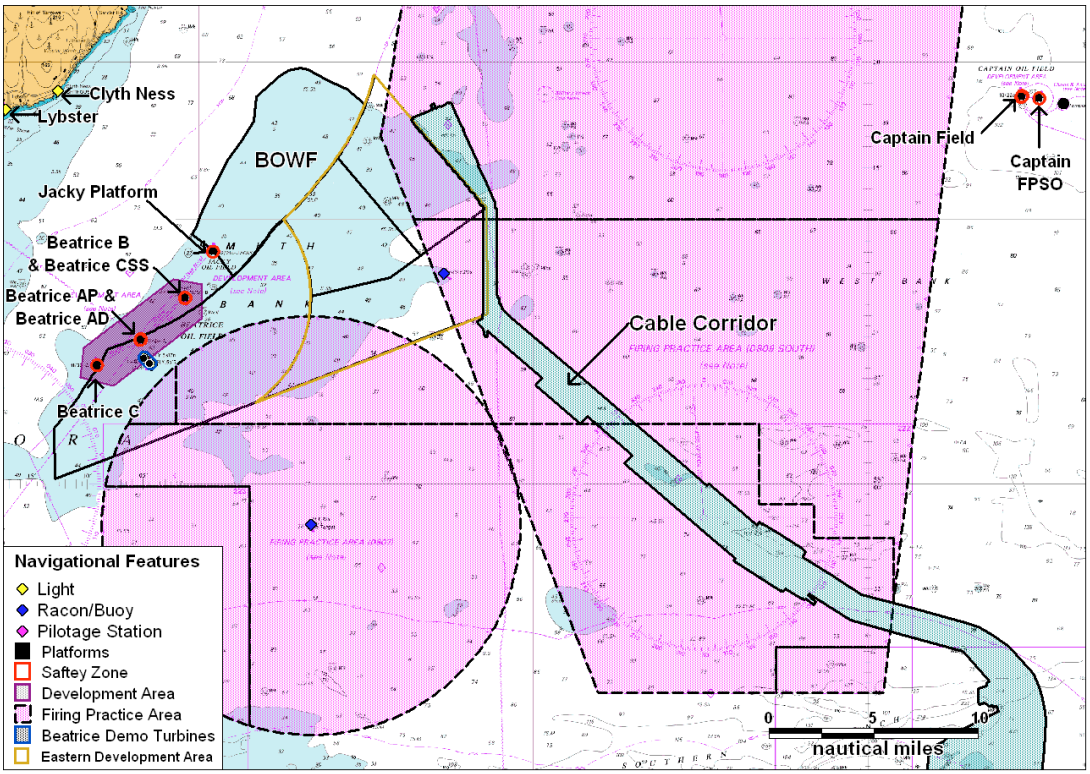

Figure 3.2 Navigational Features relative to the Cable Route (Northern Corridor)

The main navigational features relative to the offshore export cable route is the Firing Practice Area D809 (South) which the cable route intersects for approximately 34nm.

No restrictions are placed on the right to transit the firing practice area at any time. Firing practice areas are operated using a clear range procedure; exercises and firing only take place when the areas are considered to be clear of all shipping.

It is also noted that a Scottish Hydro Electric Transmission Limited (SHETL) interconnector cable from Shetland Islands and associated substation is planned to the east of the MORL Zone. This cable is being developed to link possible renewable energy projects in Shetland and northern Scotland to the mainland.

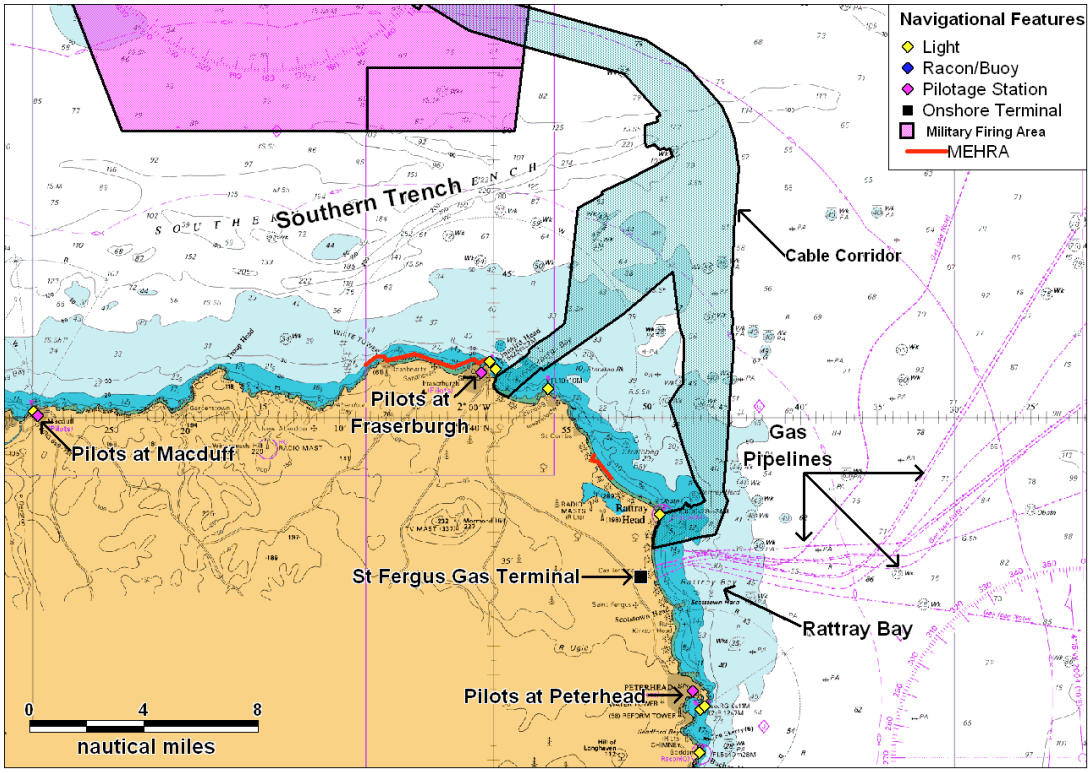

Figure 3.3 Navigational Features relative to the Cable Route (Southern Corridor)

The main navigational features relate to the two landfall options relate to two main harbours/ports in the area. The Fraserburgh Bay landfall option is located less than 1km from the harbours South Breakwater. The Rattray Head landfall option is located less than 1km north of a number of gas pipelines in Rattray Bay that run from various North Sea offshore platforms to the onshore St Fergus Gas Terminal. A chart extract for the area states:

Mariners are advised not to anchor or trawl in the vicinity of pipelines. Gas from a damaged oil or gas pipeline could cause explosion, loss of a vessel's buoyancy, or some other serious hazard. Pipelines are not always buried and their presence may effectively reduce the chartered depth by up to 2m. They may also span seabed undulations and cause fishing gear to become irrecoverably snagged, putting a vessel in severe danger.

In addition, there are two Marine Environmental High Risk Area's (MEHRA's) located within 5nm of the export cable route landfalls. The Fraserburgh Bay option is located approximately 1nm south of the Kinnaird Head MEHRA (between Rosehearty and Fraserburgh). The Rattray Head landfall option is located 2.7nm south east of the St Combs/Strathbeg Bay MEHRA.

MEHRAs have been identified by the UK Government as an area of environmental sensitivity and at high risk of pollution from ships. The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.

4. MARITIME INCIDENTS

4.1 Introduction

This section reviews maritime incidents that have occurred in the vicinity of the offshore export cable route in the last ten years.

The analysis is intended to provide a general indication as to whether the area of the cable route is currently low or high risk in terms of maritime incidents, which could result in a vessel anchoring in an emergency. Data from the following sources has been analysed:

- Marine Accident Investigation Branch (MAIB)
- Royal National Lifeboat Institution (RNLI)

*(It is noted that the same incident may be recorded by both sources.)

4.2 MAIB

All UK-flagged commercial vessels are required to report accidents to the MAIB. Non-UK flagged vessels do not have to report unless they are within a UK port/harbour or within UK 12 mile territorial waters and carrying passengers to or from a UK port (including those in inland waterways). However, the MAIB will record details of significant accidents of which they are notified by bodies such as the Coastguard, or by monitoring news and other information sources for relevant accidents. The Maritime and Coastguard Agency, harbour authorities and inland waterway authorities also have a duty to report accidents to MAIB.

The locations[1] of accidents, injuries and hazardous incidents reported to MAIB within 10nm of the offshore exportEDA cable route between January 2001 and December 2010 are presented in Figure 4.1 and Figure 4.2, colour-coded by type.

[1] MAIB aim for 97% accuracy in reporting the locations of incidents.

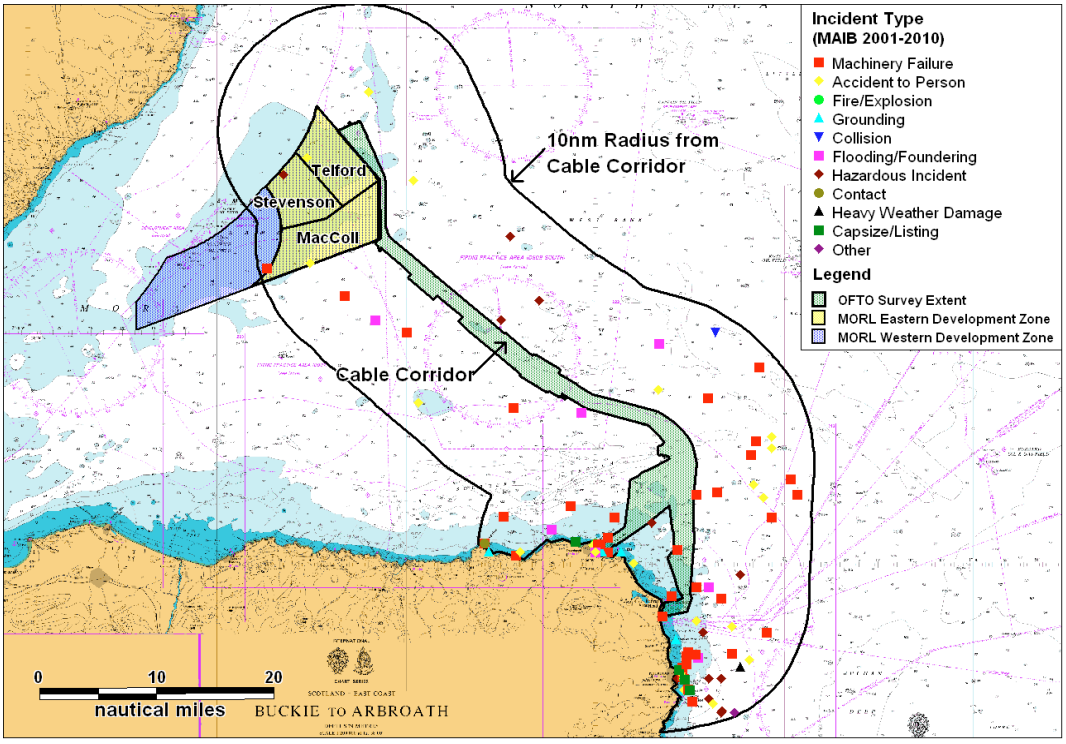

Figure 4.1 MAIB Incident Locations by Type within 10nm of Cable Route

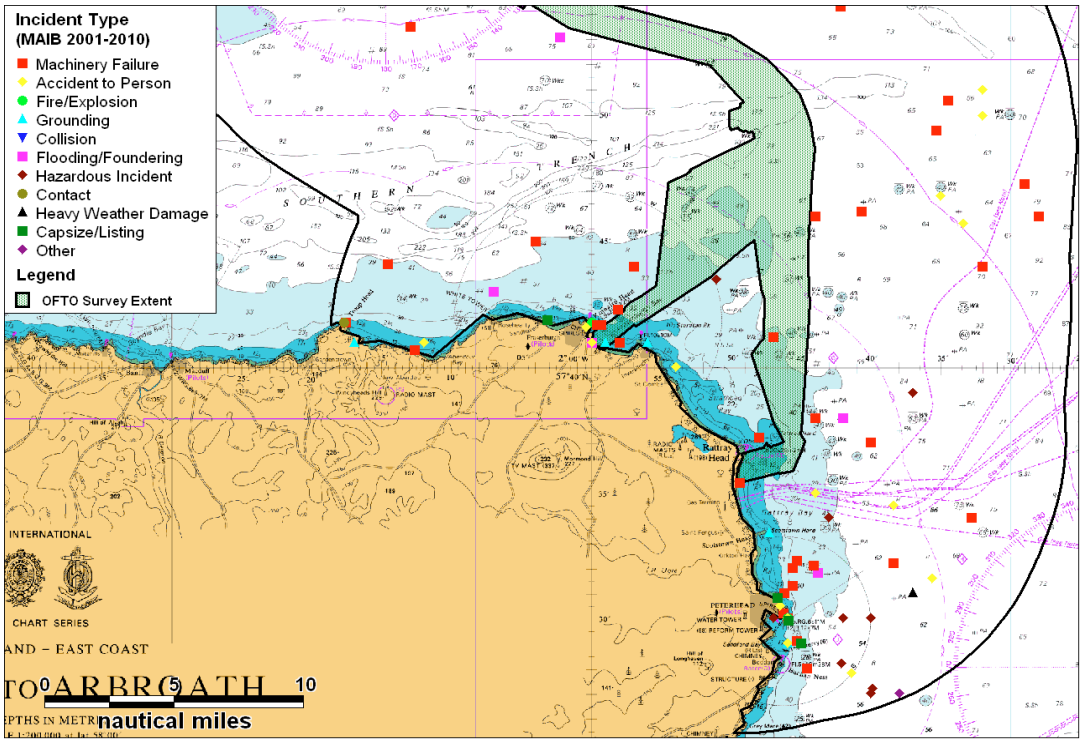

Figure 4.2 Detailed MAIB Incident Locations off Landfall Options by Type within 10nm of the Cable Route

A total of 137 incidents were reported within 10nm of the cable route, corresponding to an average of 14 per year. The majority of the incidents occurred in the coastal area between Fraserburgh Bay and Peterhead Bay. The distribution by incident type is presented in Figure 4.3.

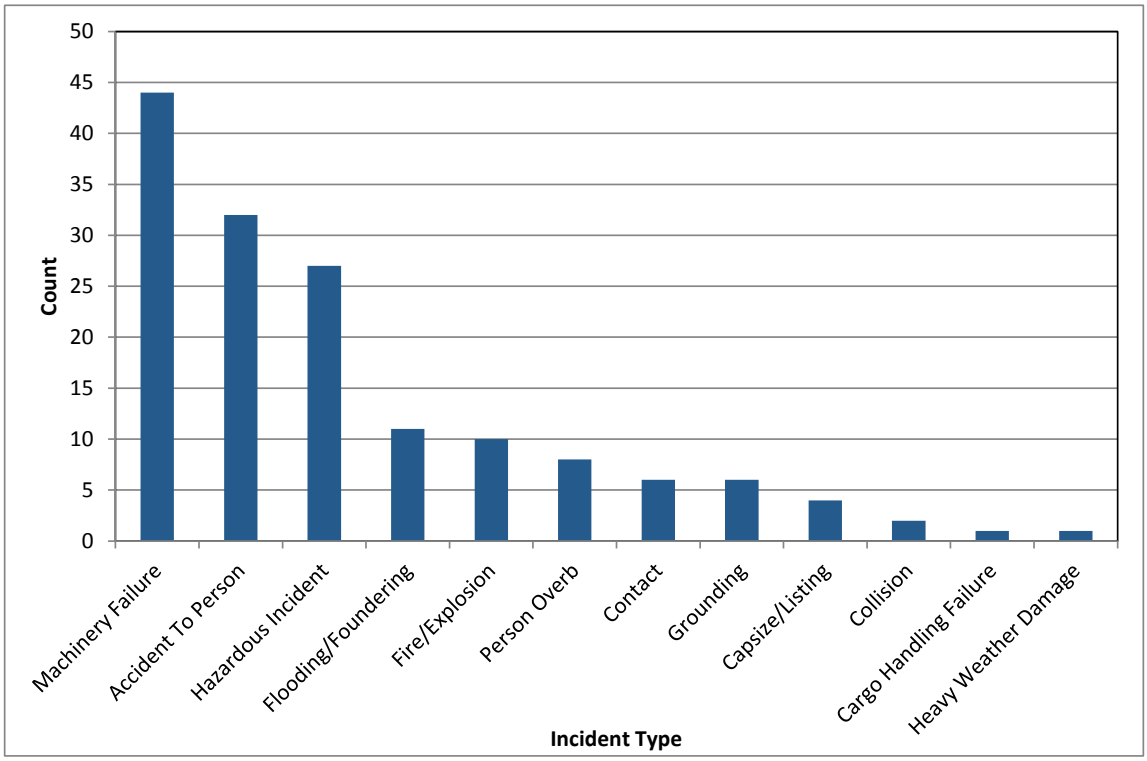

Figure 4.3 MAIB Incidents by Type within 10nm of the Cable Route (2001-2010)

The most common incident type recorded within 10nm of the offshore export cable route was machinery failure, representing 29% of all incidents over the ten year period.

There were two incidents reported within the offshore export cable route:

- Fraserburgh Bay, an incident occurred when a small hand-line fishing vessel (8m in length) became grounded in July 2006 during poor visibility and dense fog. The vessel beached at slow speed (with no damage sustained) and was re-floated at high tide with assistance from the RNLI.

- Rattray Head cable route, an incident occurred approximately 4.3nm offshore when a fishing seine netter (24m in length) had a machinery failure due to an engine overheating in January 2006. Another fishing vessel towed the vessel to safety.

It should also be noted that a large number of incidents were recorded within the Fraserburgh harbour limits, with the majority involving fishing vessels, (i.e. machinery failures, fire/explosion, person overboard and contacts).

In addition, a collision incident was recorded 9nm north by north east from the main cable route on the 8th December 2006 between a 14m stern trawler leaving port and a 244m tanker which was approaching the coast to anchor. The fishing vessel was steaming on passage and had not noticed the tanker. Last minute manoeuvres by the tanker to avoid the fishing boat were unsuccessful and minor damage was sustained between the two vessels.

4.3 RNLI

Data on RNLI lifeboat responses within 10nm of the offshore export cable route in the ten-year period between 2001 and 2010 have been analysed. A total of 201 launches were recorded for 189 incidents by the RNLI (excluding hoaxes and false alarms). There was an average of 19 incidents per year for the 10 years analysed.

Figure 4.4 and Figure 4.5, present overview and detailed plots of the geographical location of incidents colour-coded by casualty type. It can be seen that the vast majority occurred near the coast (off Fraserburgh and Peterhead Bay), with relatively few further out to sea.

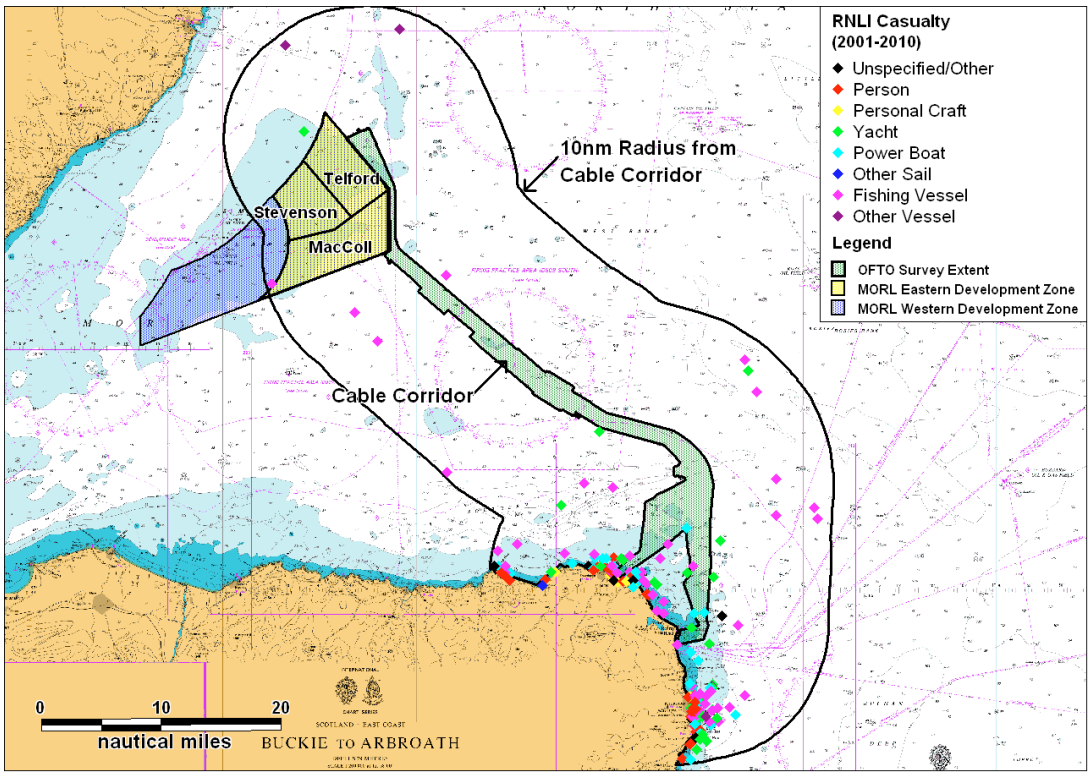

Figure 4.4 Overview RNLI Incidents by Casualty Type within 10nm of the Cable Route

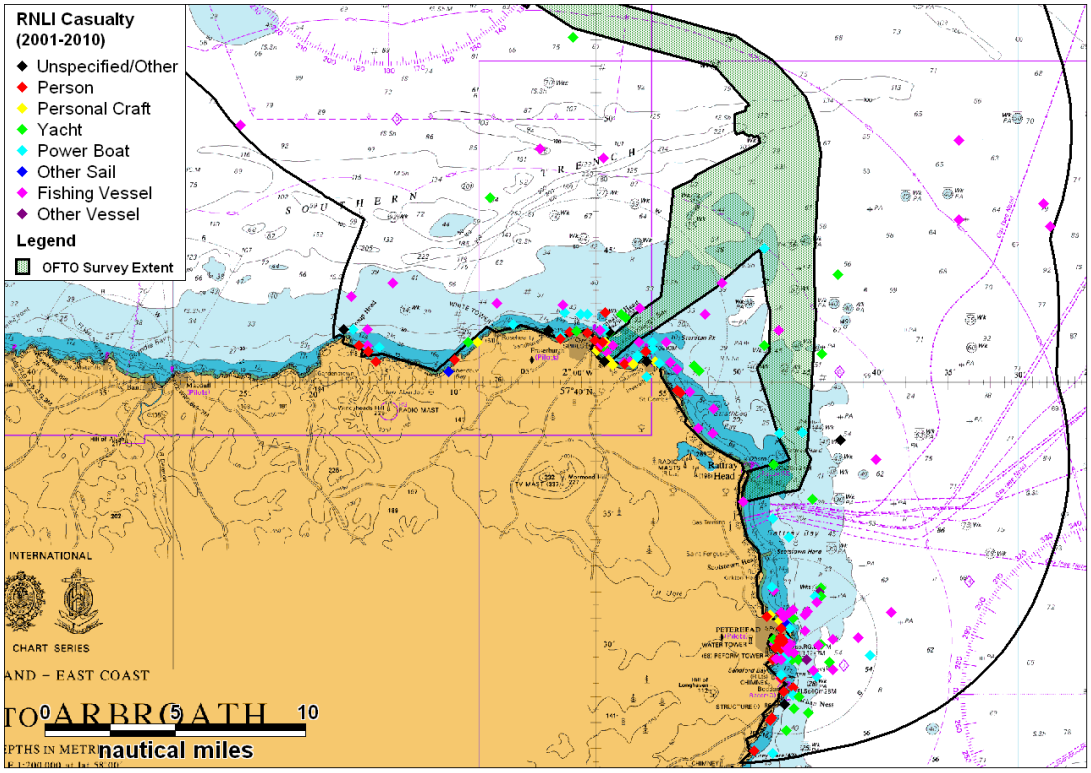

Figure 4.5 Detailed RNLI Incidents by Casualty Type for Landfall Options

Four incidents were recorded within the offshore export cable route over the 10 year period analysed, three machinery failures on recreational power boats and a machinery failure on a large fishing vessel 5.3nm north of Rattray Head.

In terms of the two landfall options, one incident was reported within the Rattray Head route in February 2007 when a very large fishing vessel had a machinery failure. Fraserburgh All-weather Lifeboat (ALB) gave assistance to the vessel and crew.

It should be noted that a relatively high number of incidents (16), generally involving fishing vessels and people, occurred in Fraserburgh harbour limits and Fraserburgh Bay and these intersected the landfall option.

The overall distribution by casualty type is summarised in Figure 4.6.

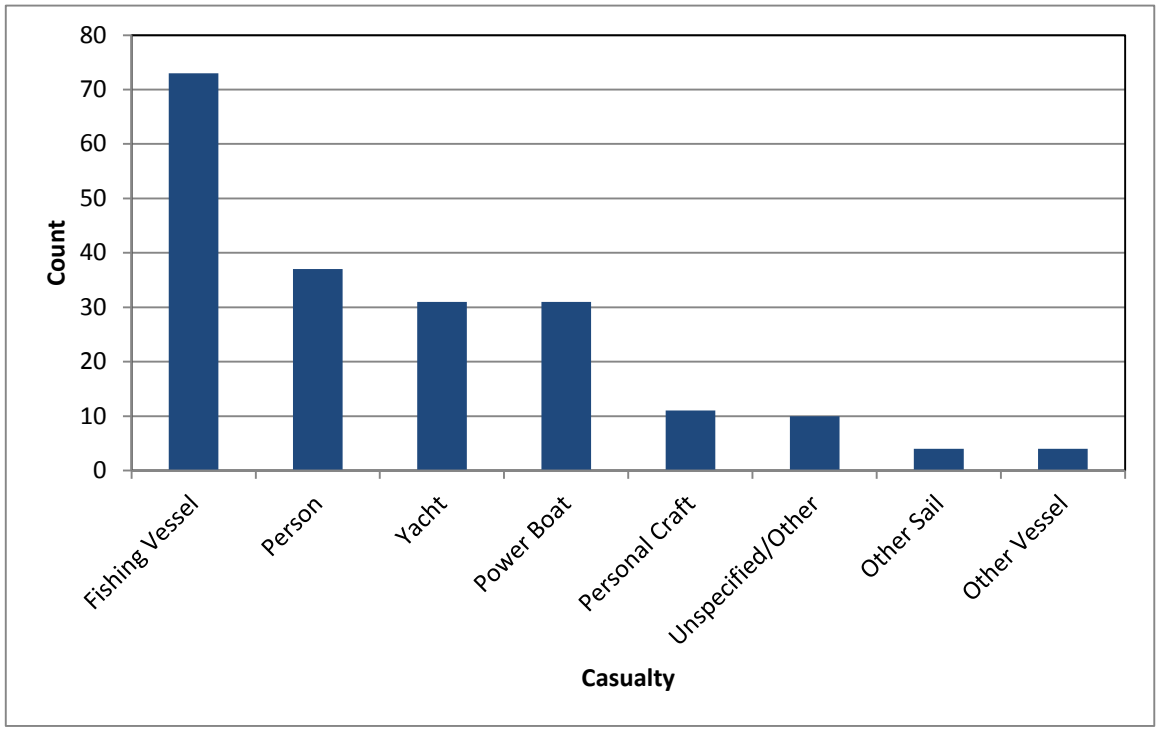

Figure 4.6 RNLI Incidents by Casualty Type within 10nm of the Cable Route (2001-2010)

Fishing (36%), person (18%) and yacht (15%) were the most common casualty types involved. The remainder of casualties were generally made up of inshore vessels, i.e. power boats (15%) and personal craft/canoes (5%).

A chart of the incidents by cause is presented in Figure 4.7.

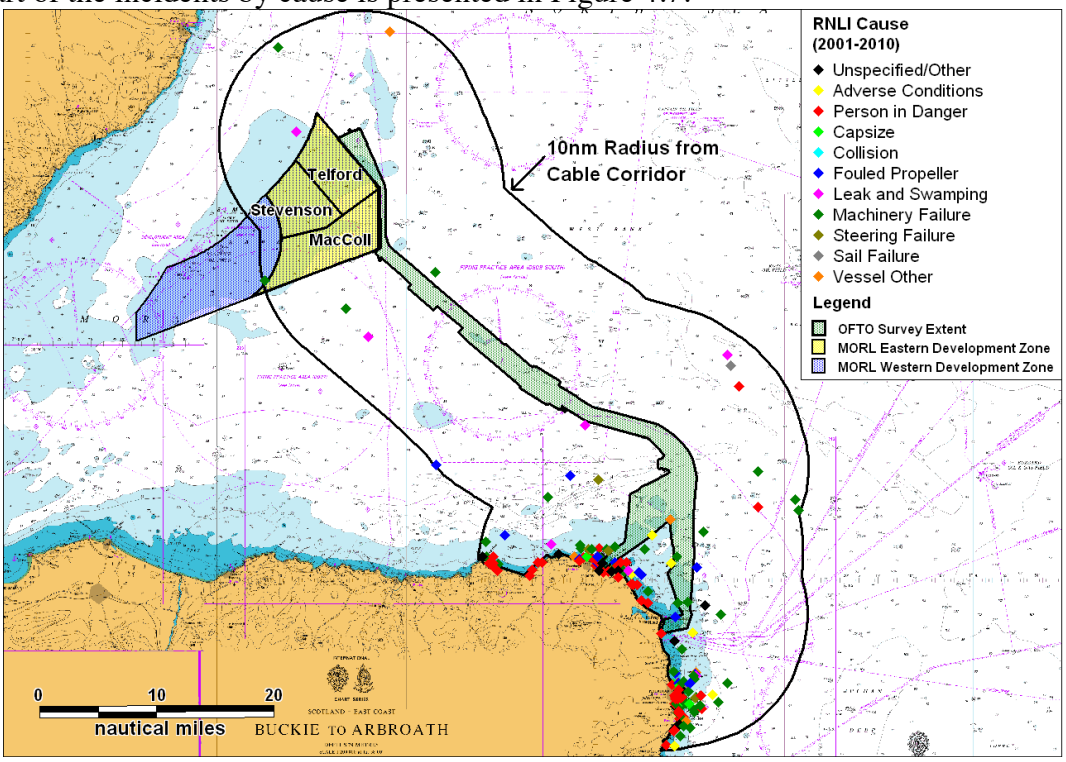

Figure 4.7 Overview RNLI Incidents by Cause within 10nm of the Cable Route

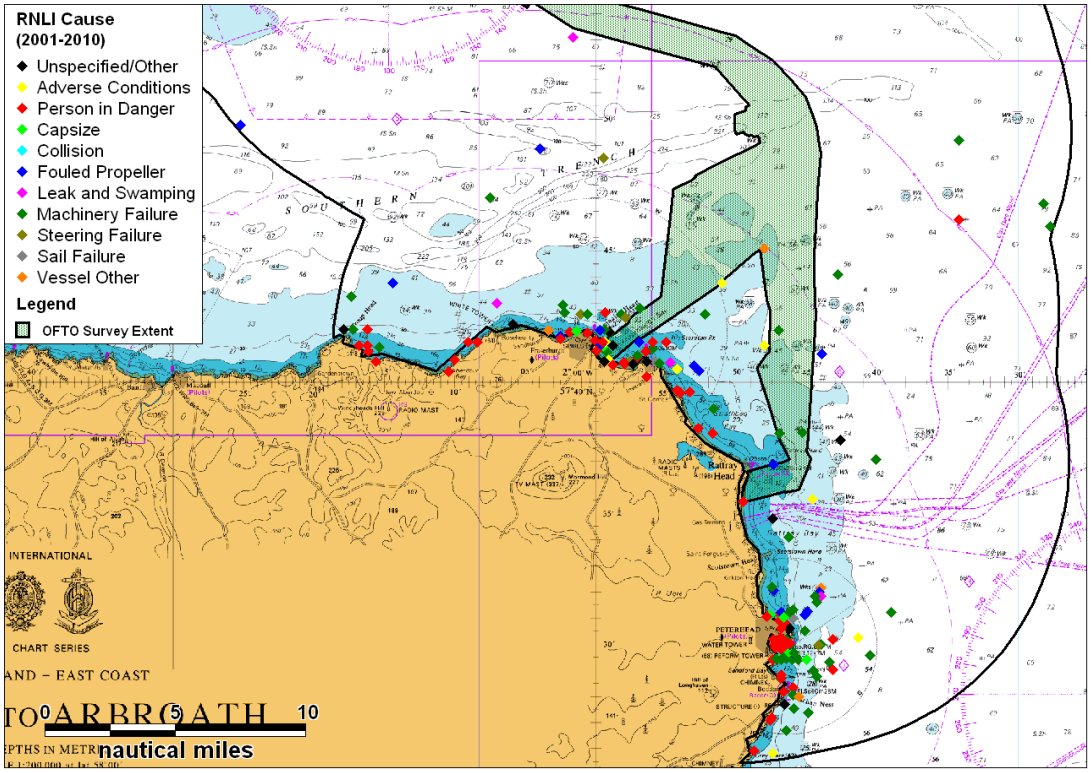

Figure 4.8 Detailed RNLI Incidents by Cause for Landfall Options

The main reported causes were person in danger (36%) and machinery failure (28%).

There are two types of RNLI lifeboats that can respond to incidents (ALB = all-weather lifeboat and ILB = inshore lifeboat). From the ten year period of RNLI data analysed (2001-2010), it was noted that approximately 94% of incidents within 10nm of the offshore export cable route were responded to by Fraserburgh or Peterhead ALB.

4.4 Conclusions

Based on the review of incidents, it can be seen that the proposed export cable route from three proposed wind farms and its immediate vicinity has experienced a relatively low rate of accidents in recent years, especially over 5nm from the coast and landfall options.

Most incidents in the area have occurred within 3nm of the coastline at Fraserburgh and Peterhead Bay. It was considered that the area in the vicinity of the Rattray Head cable route had a lower overall accident rate compared to the Fraserburgh Bay landfall option.

5. MARITIME TRAFFIC SURVEYS

5.1 Introduction

This section summarises the results of the maritime traffic survey carried out in the Moray Firth relative to the offshore export cable route during summer 2011.

5.2 Survey Details

An AIS shipping based survey took place from 6th July to 2nd October 2011 from the geophysical survey vessel MV *Ivero*. A library image of this vessel is presented in Figure 5.1.

Figure 5.1 Library Image of survey vessel *Ivero*

Given the size of the cable route survey area, AIS coverage occasionally dropped-off at the extremities of the area during survey operations, i.e. at the landfall options when the vessel was in the northern part of the cable route. Therefore Anatec supplemented the *Ivero* survey data with coastal based AIS to improve and provide comprehensive AIS coverage for the entire cable route.

Tracks of the *Ivero* vessel recorded on AIS during survey operations in the cable corridor are presented in Figure 5.2.

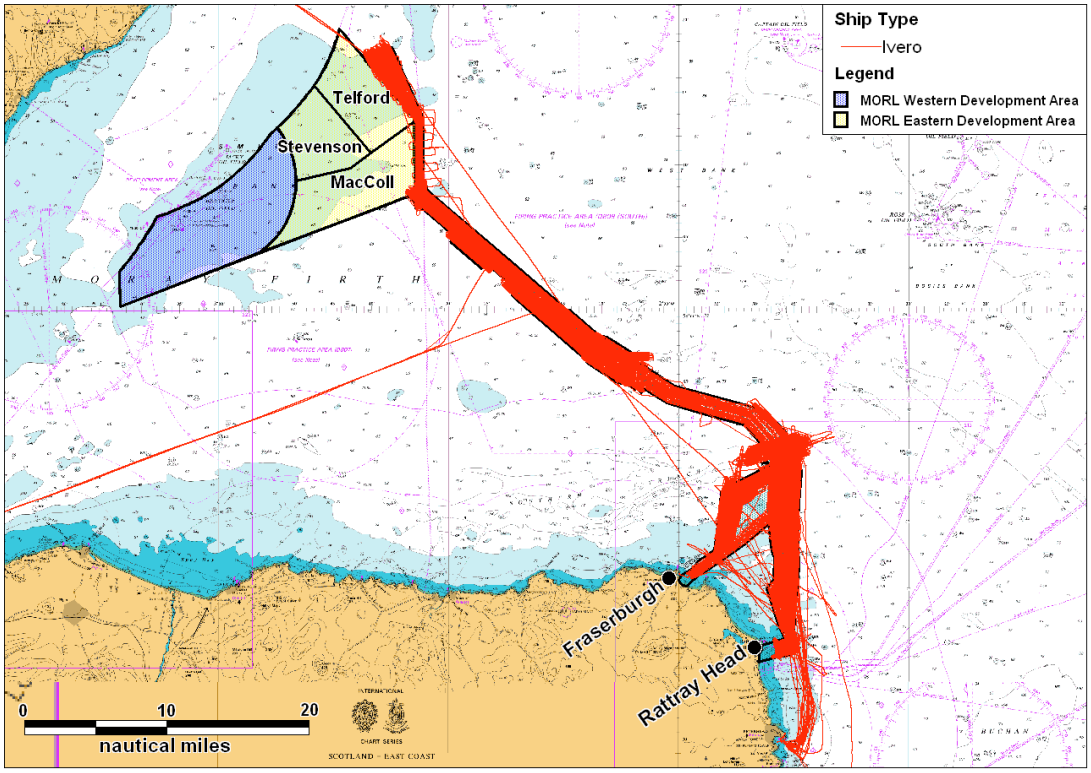

Figure 5.2 ***Ivero*** **Survey Vessel Positions 6th July to 2nd October 2011**

5.3 Survey Plots

AIS shipping data for the survey duration is presented for a representative 28 day period within 10nm of the offshore export cable route to identify vessel types passing through the area and vessel activity relative to the cable landfall options. It is noted that survey vessel tracks are excluded from the analysis.

Charts of the vessels recorded on AIS from 26th August to 22nd September 2011, colour-coded by ship type, are presented in Figure 5.3 and Figure 5.4.

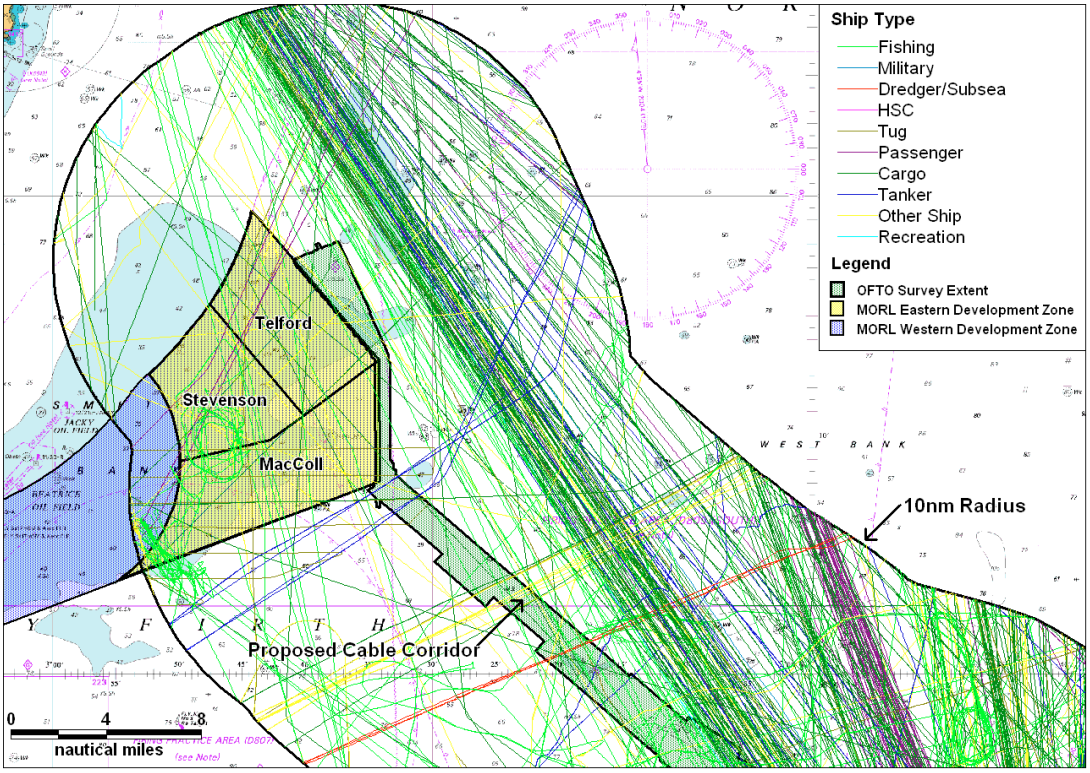

Figure 5.3 *Ivero* Survey Northern Section of the Cable Route (28 Days AIS tracks)

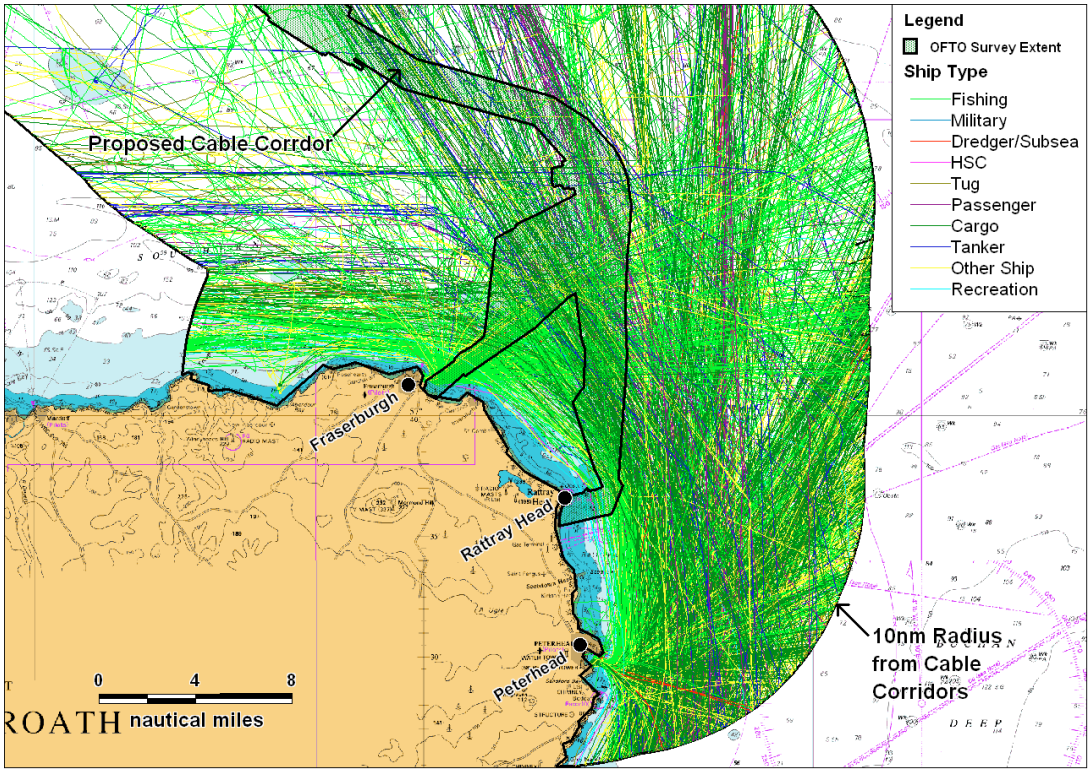

Figure 5.4 ***Ivero*** **Survey Southern Section of Cable Route (28 Days AIS tracks)**

The number of unique vessels within 10nm of the offshore export cable route averaged approximately 70 vessels per day (excluding vessels recorded entirely within port at Fraserburgh and Peterhead).

As can be observed from the shipping plots, the majority of vessel tracks were fishing vessels headed to/from fishing grounds to land fish in Fraserburgh and Peterhead. In addition, vessels were recorded heading north/south off the Aberdeenshire coast, including the North Link ferry route to the Northern Isle (from Aberdeen). Shipping also passes north by north west / south by south east from Rattray Head to Pentland Firth.

A less trafficked route passes east/west into the Moray Firth headed to the ports of Inverness and Invergordon (in the Cromarty Firth).

In general, shipping in this area keeps at least 1-2.5nm north and east of the Moray and Aberdeenshire coast. However a small number of recreation and fishing vessels can pass closer to coastline dependant on draught.

The breakdown of ships by type for vessels within 10nm of offshore export cable route is presented in Figure 5.5. This considers all vessels recorded during the 28 day period.

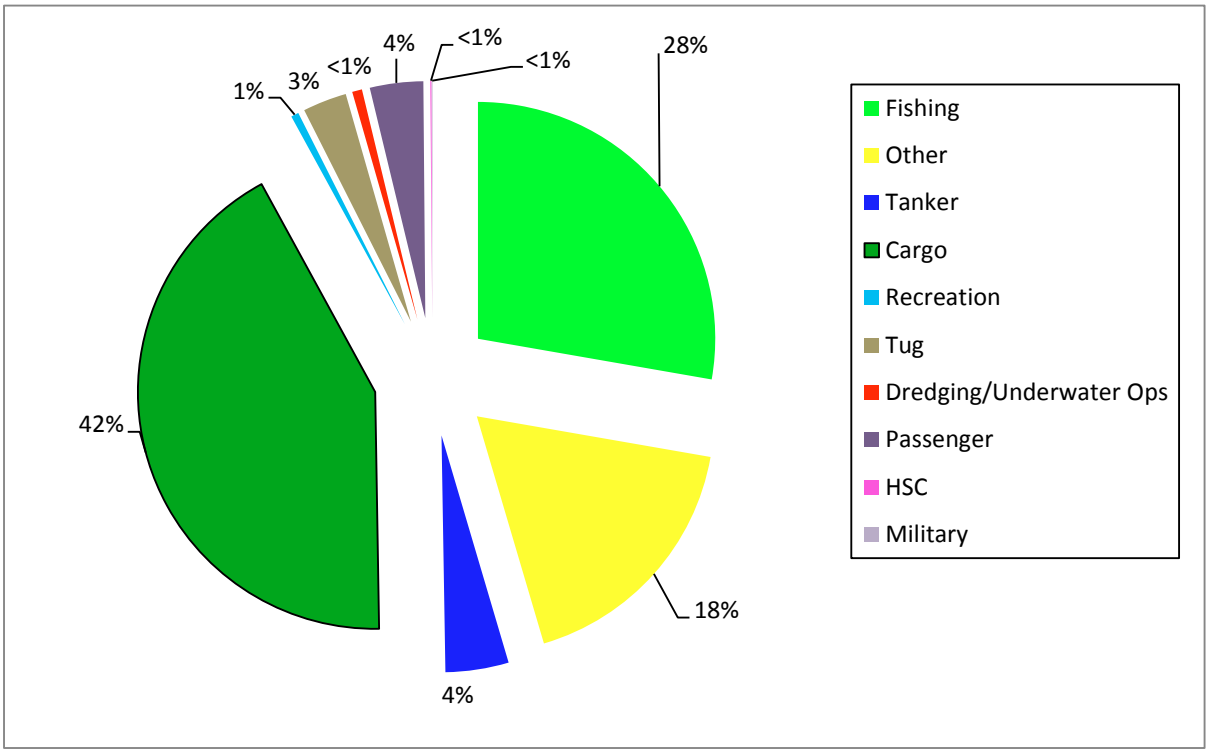

Figure 5.5 Vessel Types identified during the Survey (28 days)

The most common vessel type recorded during the 28 day survey were cargo ships (42%), fishing vessels (28%) and other vessels contributing (18%).

A portion of cargo, tugs and other vessels were offshore oil and gas industry related, i.e. supporting North Sea oil and gas fields and other North Sea operations.

It is noted that offshore vessels were also recorded anchored in Aberdour Bay whilst waiting on orders. A detailed analysis of anchored vessels is provided in Section 5.4.

5.4 Anchored Vessels

The positions of vessels at anchor within 10nm of the offshore export cable route recorded during the combined survey period, 6th July to 2nd October 2011 (84 days) are presented in Figure 5.6.

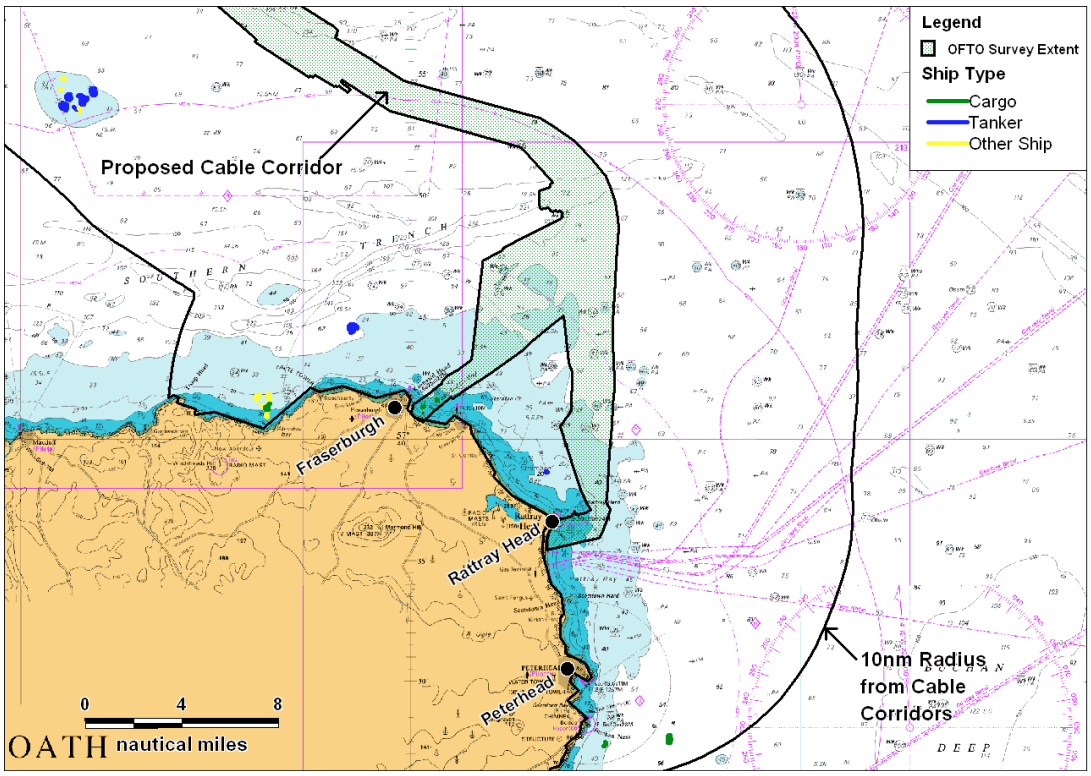

Figure 5.6 Anchored Vessels during Survey July to October 2011 (84 Days)

Five vessels were recorded at anchor within Aberdour Bay 7.3nm west of the Fraserburgh cable route. These vessels were composed of four offshore supply vessels and one general cargo vessel.

Further offshore, larger vessels including tankers anchor in an area of shallower water (39 to 50m), north of the Southern Trench approximately 7nm south west off the cable route. From the combined survey period a shuttle tanker *Aberdeen* (221m in length broadcasting a draught of 8.5m) was recorded at anchor for 16 days during July, August and September 2011.

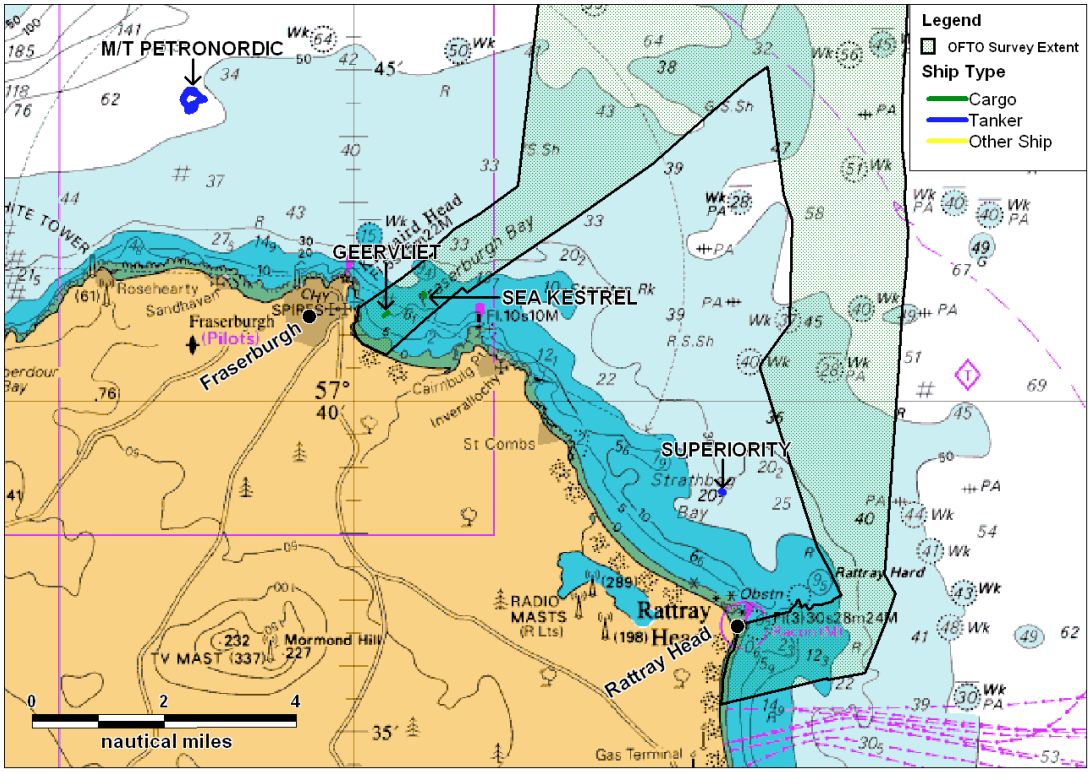

Figure 5.7 Detailed Fraserburgh and Rattray Head Anchored Vessels (84 days)

Within the Fraserburgh Bay cable route two cargo vessels were recorded at anchor during three days. The nearest anchored vessel to the Rattray Head cable route was a tanker located 1.5nm west of the cable anchored in Srathbeg Bay for one day in September 2011.

In addition, a shuttle tanker *M/T Petronordic* was recorded at anchor for four days approximately 4nm north west of the Fraserburgh Bay cable route.

A summary of the three closest or intersecting anchored vessels recorded during the combined survey period is provided below:

- The general cargo vessel *Geervliet* (86m in length, broadcasting a draught of 5.3m) was recorded anchored in the cable route. This vessel was anchored approximately 0.6nm east of Fraserburgh for 1 day during July 2011.
- The general cargo vessel *Sea Kestrel* (78m in length, broadcasting a draught of 3.9m) was recorded for 2 days during September 2011, approximately 1nm east of Fraserburgh.
- The third closest anchored vessel to the cable route was a chemical/products tanker *Superiority* (95m in length, broadcasting a draught of 6m) 1.5nm east of the proposed Rattray Head cable route.

6. RECREATIONAL VESSEL ACTIVITY

6.1 Introduction

This section reviews recreational vessel activity relative to the offshore export cable route from the three proposed wind farm sites based on 28 days survey data collected during August and September 2011 and information published by the Royal Yachting Association (RYA).

6.2 Survey Data

Figure 6.1 presents the AIS recreation vessel tracks recorded from the *Ivero* survey relative to the proposed cable route and landfall options.

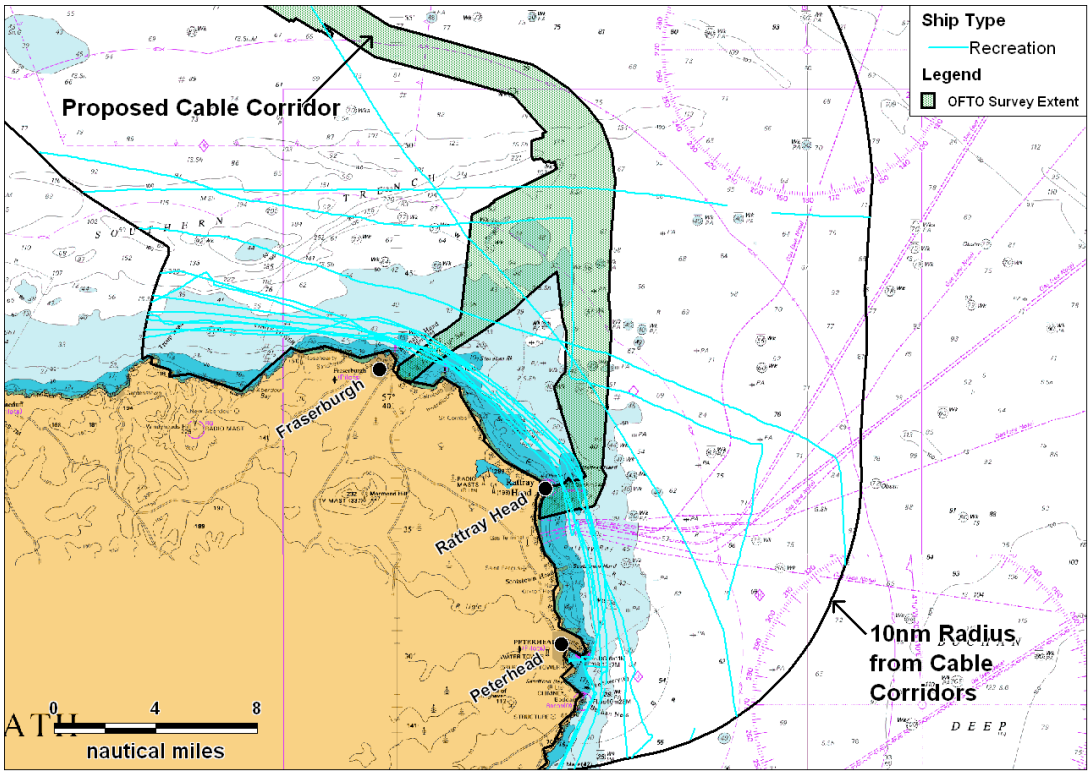

Figure 6.1 Recreation Vessels Recorded during Survey (28 days)

On average there was just under one recreational vessel recorded during the survey within 10nm of the offshore export cable routes. The majority of vessels were recorded transiting along the Aberdeenshire and Banff/Buchan coastline (within 2nm of land) off Rattray Head, Fraserburgh and Rosehearty.

6.3 RYA Data

6.3.1 Introduction

The RYA, supported by the CA, have identified recreational cruising routes, general sailing and racing areas around the UK in the Coastal Atlas (Ref. ii). This work was based on extensive consultation and qualitative data collection from RYA and CA members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

The reports note that recreational boating, both under sail and power is highly seasonal and highly diurnal. The division of recreational craft routes into Heavy, Medium and Light Use is therefore based on the following classification:

- *Heavy Recreational Routes*: - Very popular routes on which a minimum of six or more recreational vessels will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge.
- *Medium Recreational Routes*: - Popular routes on which some recreational craft will be seen at most times during summer daylight hours.
- *Light Recreational Routes*: - Routes known to be in common use but which do not qualify for medium or heavy classification.

6.3.2 Offshore Export Cable Route Recreational Data

A chart of the recreational sailing activity and facilities relative to the offshore export cable route is presented in Figure 6.2.

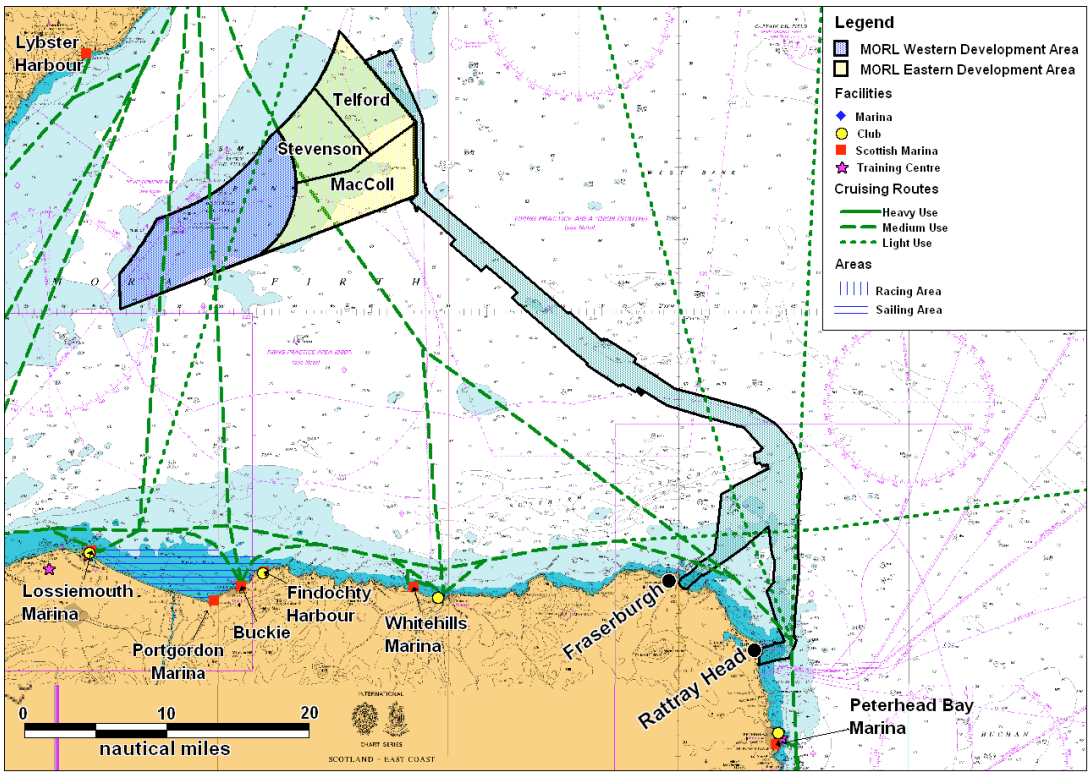

Figure 6.2 Recreational Information for the Moray Firth and Cable Route

In terms of facilities, there are a number clubs, training centres and marinas for recreational vessels located on the coast around Moray, Aberdeenshire and Caithness/Sutherland.

The nearest marina and club to the offshore export cable route is located at Peterhead approximately 6.5nm to the south. There are also two medium-use routes that pass over the cable route, from eastern Scotland to the inner Moray Firth and the northern Isle.

7. FISHING VESSEL ACTIVITY

7.1 Introduction

This section reviews the fishing vessel activity relative to the offshore export cable route from the three proposed wind farms based on sightings and satellite data.

7.2 Survey Data

The following chart presents the AIS fishing vessel tracks recorded from the *Ivero* survey relative to the cable route and landfall options.

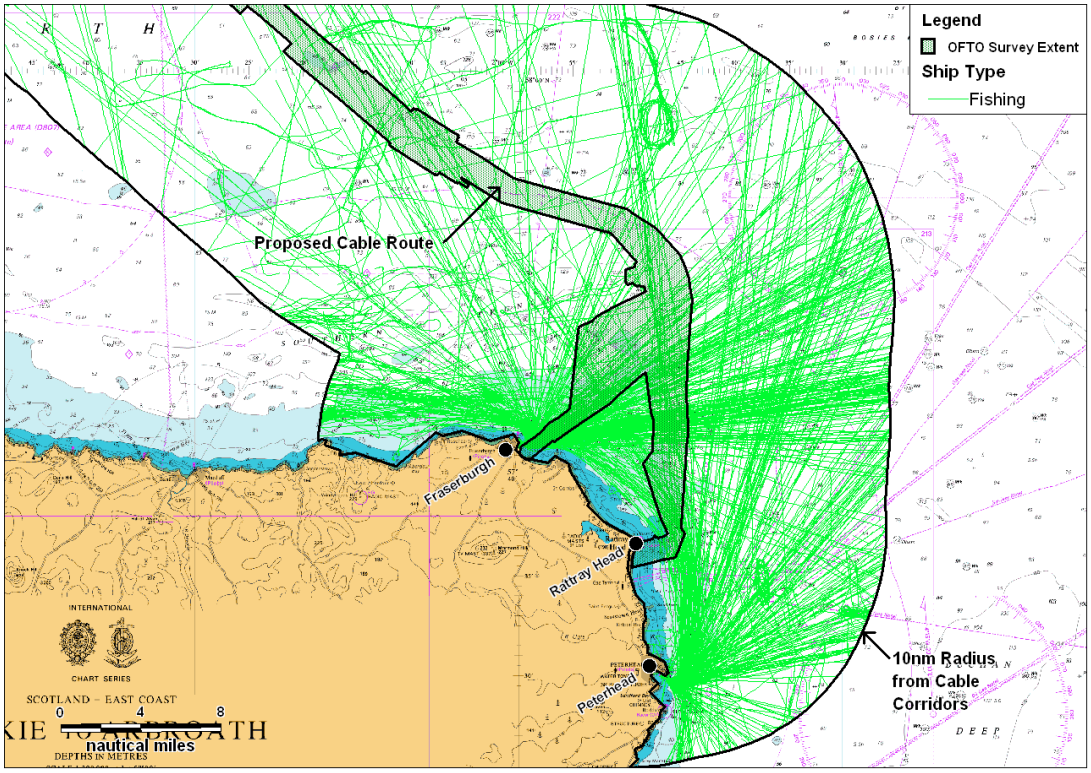

Figure 7.1 Fishing Vessels recorded During Survey (28 days)

On average there were 110 fishing vessels recorded during the survey within 10nm of the cable route. It can be observed that fishing vessel tracks were mostly recorded headed in/out of the fishing ports of Fraserburgh and Peterhead, where fish is landed for markets.

In terms of the offshore export cable route, most fishing vessels were steaming to/from fishing ports within 5nm of the cable landfalls (as apposed to engaged in fishing).

7.3 Surveillance Data Overview

7.3.1 Geographical Division

Fisheries statistics in the UK are reported by ICES statistical Rectangles and Subsquares. The proposed offshore export cable route is located within ICES Rectangle (44E6, 45E6 and 45E7), Subsquares 44E6/2, 44E6/4, 45E6/4 and 45E7/3.

7.3.2 Sightings Data

Data on fishing vessel sightings were obtained from Marine Management Organisation (MMO). The Sea Fisheries Inspectorate (SFI) monitor the fishing industry's compliance with UK, EU and international fisheries laws through the deployment of patrol vessels, surveillance aircraft and the sea fisheries inspectorate.

Each patrol logs the positions and details of all fishing vessels (UK and non-UK) within the Rectangle being patrolled. All vessels are logged, irrespective of size, provided they can be identified by their Port Letter Number (PLN).

Data was obtained for the five-year period (2005 to 2009). Section 7.4 presents the sightings data analysis.

7.3.3 Satellite Data

The Marine Management Organisation (MMO), formerly the Marine and Fisheries Agency, operates a satellite vessel monitoring system from its Fisheries Monitoring Centre in London. The vessel monitoring system is used, as part of the sea fisheries enforcement programme, to track the positions of fishing vessels in UK waters. It is also used to track all UK registered fishing vessels globally.

Vessel position reports are received approximately every 2 hours unless a vessel has a terminal on board which cannot be polled and then it must report once per hour. The data covers all EC countries within British Fisheries Limits and certain Third Countries, e.g., Norway and Faeroes. Vessels used exclusively for aquaculture and operating exclusively within baselines are exempt.

Satellite monitoring data from 2009 was analysed (including UK and non-UK fishing vessels).

7.4 Sightings Data

7.4.1 Sightings per Patrol

The numbers of fishing vessel sightings, surveillance patrols and hence average sightings per patrol within each ICES Subsquare encompassing the offshore export cable route in the five-year period 2005-09 are presented in Table 7.1.

Table 7.1 Average sightings per patrol (2005-09)

ICES Subsquare	Sightings	Patrols	Sightings per Patrol
44E7/1	423	274	1.5
44E7/2	505	283	1.8
44E7/4	112	215	0.5
45E7/1	81	324	0.3
45E7/2	103	253	0.4
45E7/3	107	253	0.4
45E7/4	77	324	0.2
44E8/1	278	306	0.9
44E8/3	341	364	0.9
45E8/3	116	236	0.5

Therefore, the Subsquares had approximately 1 fishing vessel sighting per patrol. Subsquare 44E7/2 had a higher average sighting per patrol. The sightings data were imported into a GIS for mapping and analysis.

Within the offshore export cable route, a total of 92 fishing vessels were sighted, with the majority outside the cable corridor (96%).

7.4.2 Sightings Nationality Analysis

In total 19 sightings were from non-UK registered vessels, representing less than 1% of fishing vessels.

7.4.3 Sightings Gear Analysis

The fishing vessel sightings colour-coded by gear type are presented in overview and detailed plots in Figure 7.2 and Figure 7.3.

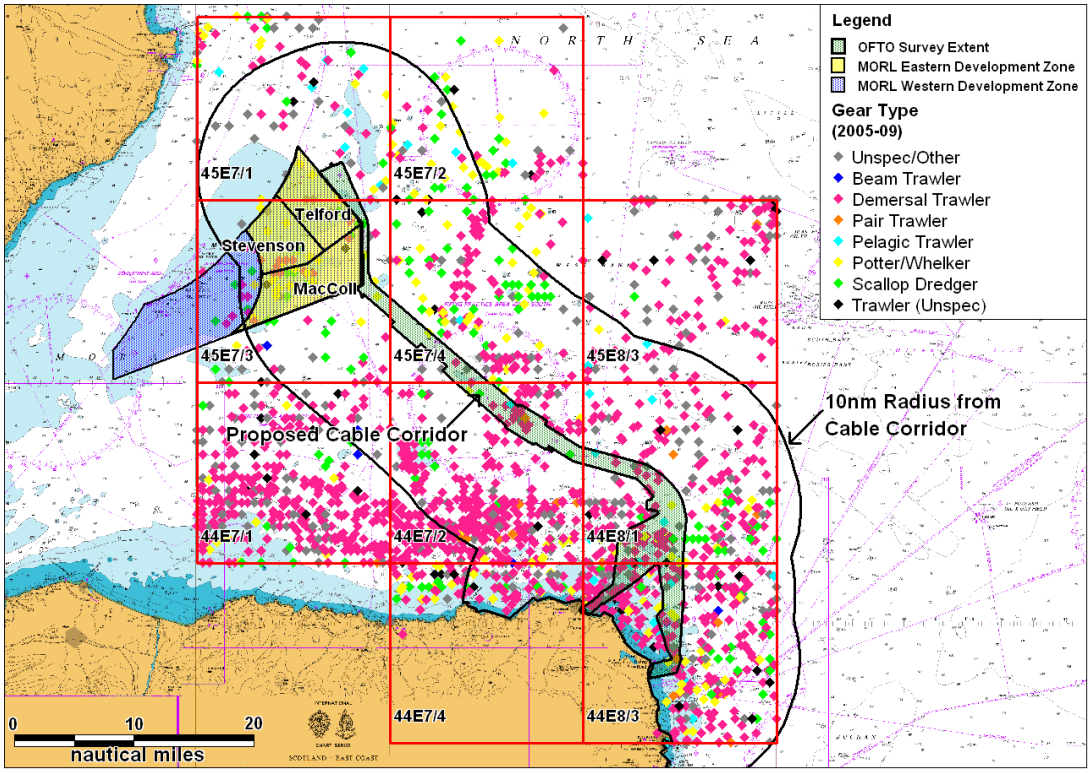

Figure 7.2 Overview Fishing vessels Gear Type

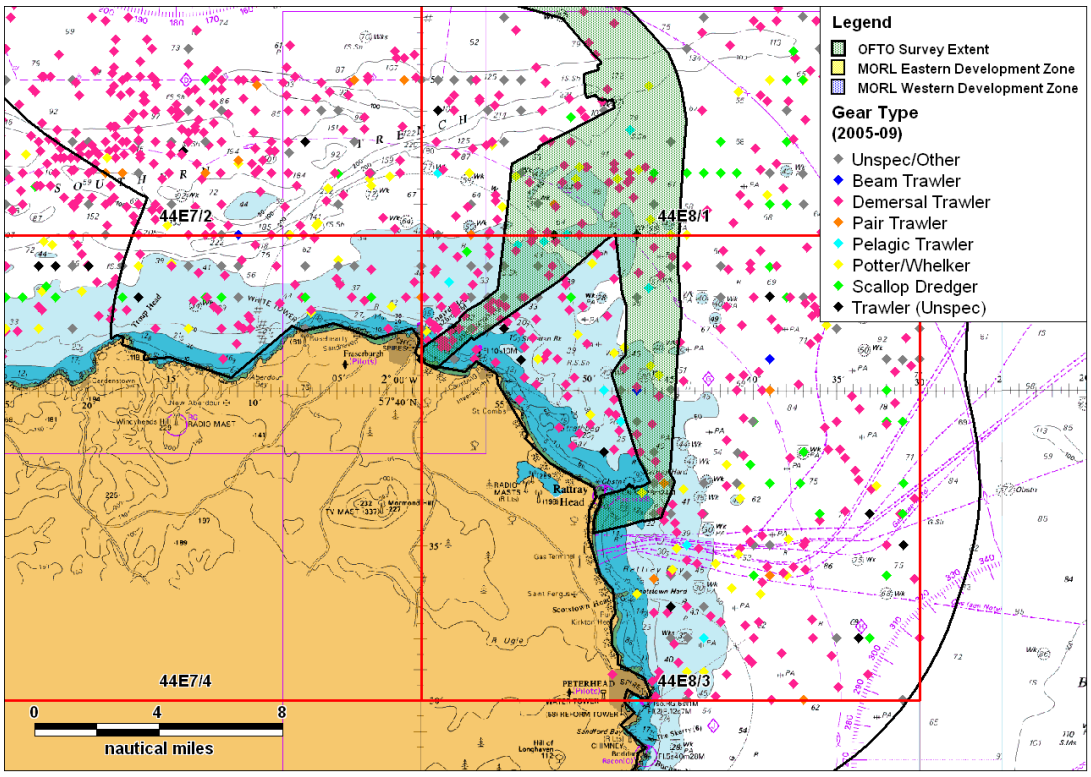

Figure 7.3 Detailed Fishing vessels Gear Type for Landfall Options

The main fishing method overall was demersal trawling, accounting for approximately 61% of all sightings with scallop dredgers and potters accounting for 16% of sightings. It is noted that 16% of sightings were unspecified.

In terms of the cable route, the majority of sightings were recorded intersecting and in close proximity to the Fraserburgh Bay route and vessels were identified as demersal trawlers.

7.4.4 Sightings Activity Analysis

The fishing vessels colour-coded by activity when sighted are presented in Figure 7.4.

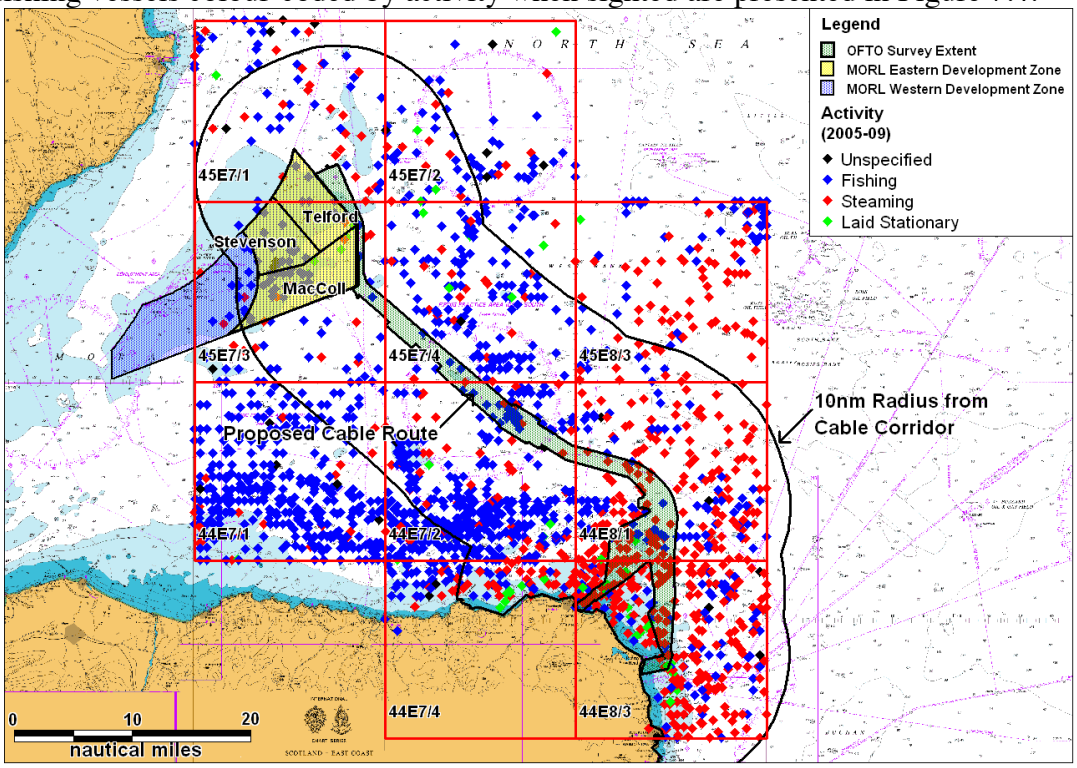

Figure 7.4 Overview Fishing vessels by Activity

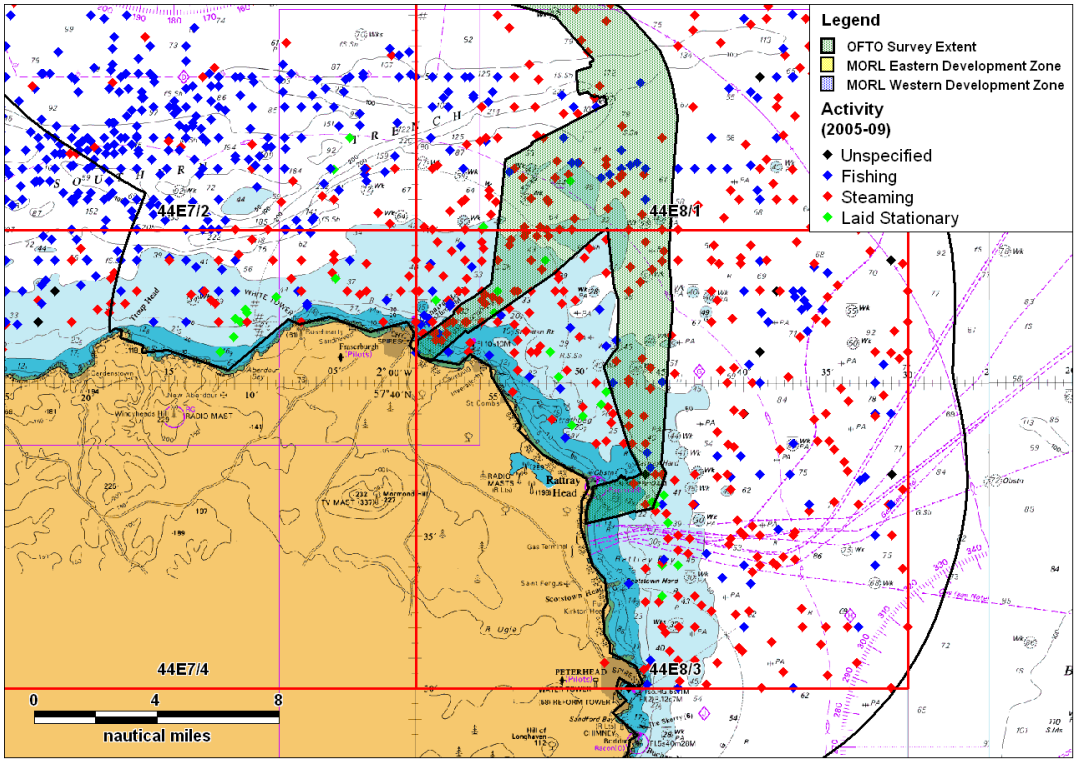

Figure 7.5 Detailed Fishing vessels by Activity for Landfall Options

Excluding unspecified (2%), 65% of vessels sighted were engaged in fishing, i.e., gear deployed, 31% were steaming (transiting to/from fishing grounds to fishing ports including Peterhead and Fraserburgh) and 2% were laid stationary (vessels at anchor or pair vessels whose partner vessel is taking the catch whilst the other stands by).

Within the offshore export cable route, 29% of vessels sighted were engaged in fishing (46) and 67% were steaming (107). The remaining vessels were either laid stationary (3%) or activity was not specified (1%).

7.5 Satellite Data Analysis

The sightings data indicates that the majority of fishing vessels in the area are registered in the UK. Furthermore, from the 2009 satellite data less than 2% of the positions recorded were foreign vessels, (1.1% Faroes, 0.4% Norwegian and 0.2% Danish with 0.2% made up of other countries).

The fishing vessel satellite positions recorded in 2009, colour-coded by vessel type (where available), is presented in Figure 7.6.

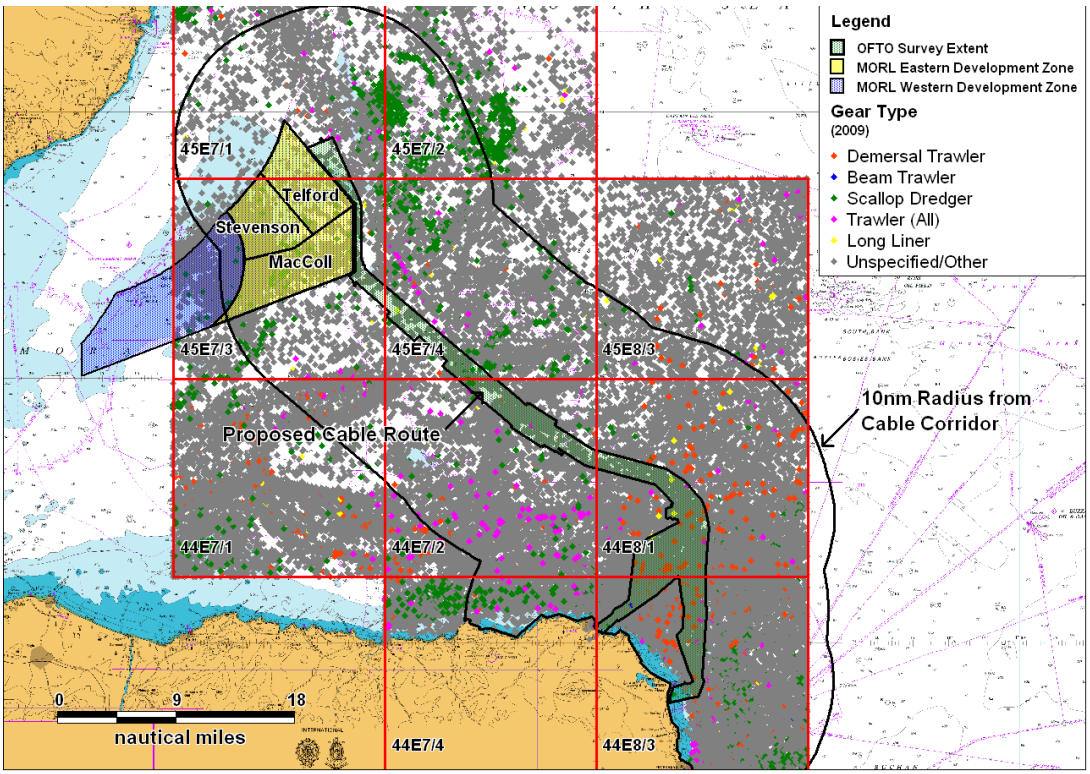

Figure 7.6 Overview Chart of Fishing Vessel Positions by Type (2009)

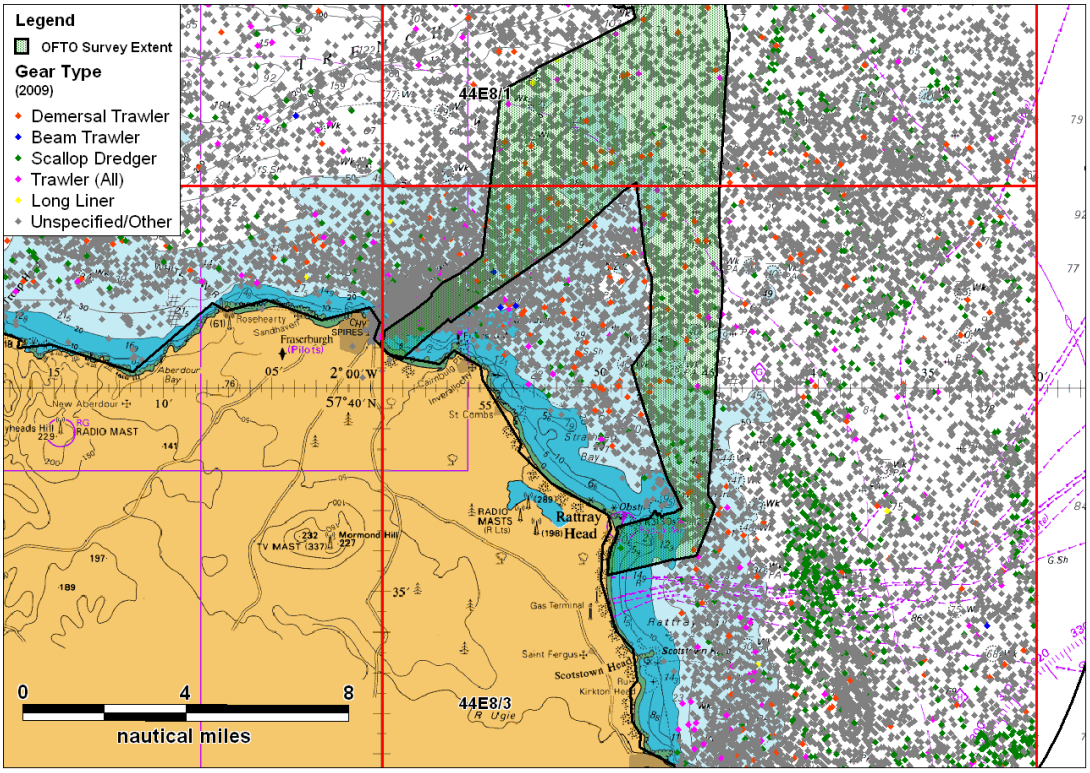

Figure 7.7 Detailed Chart of Fishing Positions by Type (2009) for Landfall Options

Excluding unspecified (95%), the majority of vessels recorded by satellite tracking were demersal stern trawlers (2%) and scallop dredgers (1.5%), with the remaining vessels made up of other trawlers (pair/beam/side) and long liners.

From the satellite positions plot it can be seen that there are relatively higher density areas of fishing vessels recorded within the Fraserburgh Bay cable route, (i.e. within 4nm of port approaches). However it is noted the vast majority of vessel sighting speeds were over 6 knots (90%), and hence were likely to be on transit to/from port.

Vessel gear types identified within the offshore export cable route were mostly unspecified (95.1%). The remaining vessels were demersal/pelagic trawlers (3.5%) and scallop dredgers (1.0%), with remaining positions made up of other trawlers and long liners (0.4%).

8. RISKS TO CABLE

8.1 Introduction

This section describes the main hazards which could pose a risk to the offshore export cable route from the three proposed wind farms. The following hazards are described in detail:

- Fishing gear interaction
- Vessel foundering
- Dropped object
- Anchoring

8.2 Fishing Gear Interaction

The fishing types considered to be most risk to a subsea cable are bottom trawling (on the seabed) and scallop dredging. This differs from mid water trawling (pelagic) where the net is towed higher in the water column and poses no risk of interaction with a subsea cable.

8.2.1 Demersal Trawl (Otter Trawl)

This is the most commonly used towed gear in UK fisheries. Both finfish and shellfish found on or near the bottom are taken by this method.

The gear consists of a net in the shape of a funnel attached to the vessel by wire ropes or 'warps'. As the net is towed over the sea floor the mouth is kept open by a combination of boards, floats and weights. The tail end of the net where the fish are trapped is the 'cod end'. Figure 8.1 presents a schematic of a typical Bottom (Otter) trawler.

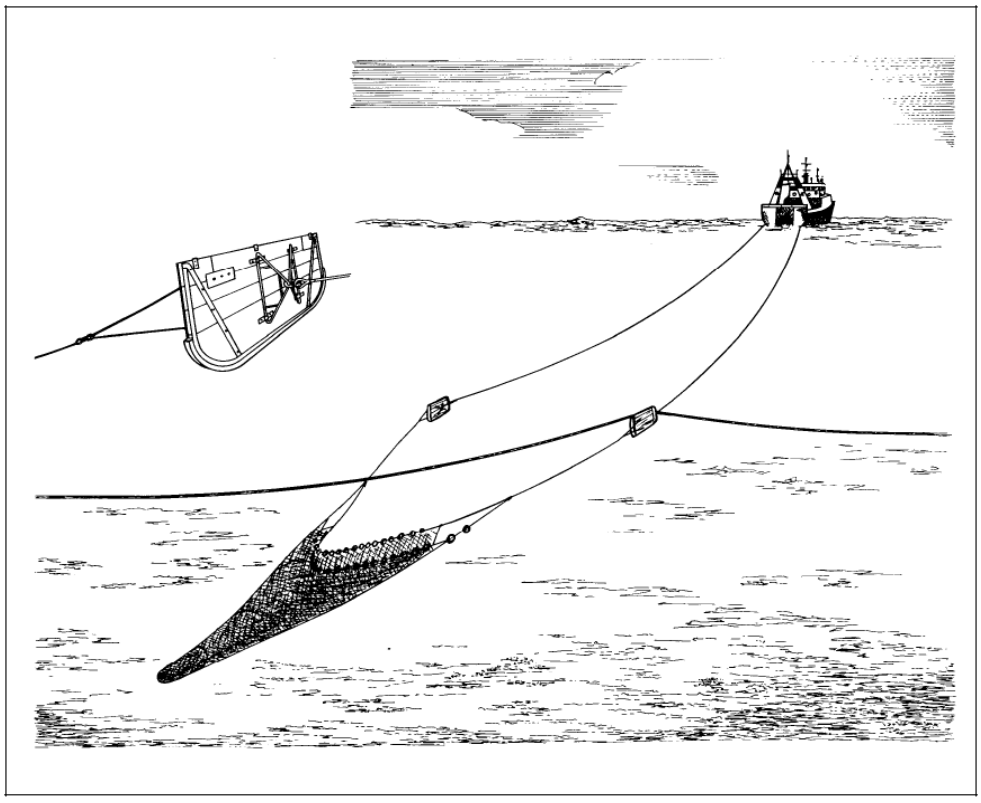

Figure 8.1 Example of Bottom (Otter) Trawl Catching a Cable (Ref. iii)

The length of the warp is normally about three and a half to four times the depth of the water and can be used in depths of 100-450m from the stern of the vessel. Figure 8.2 presents a schematic of a Twin Demersal Otter trawler.

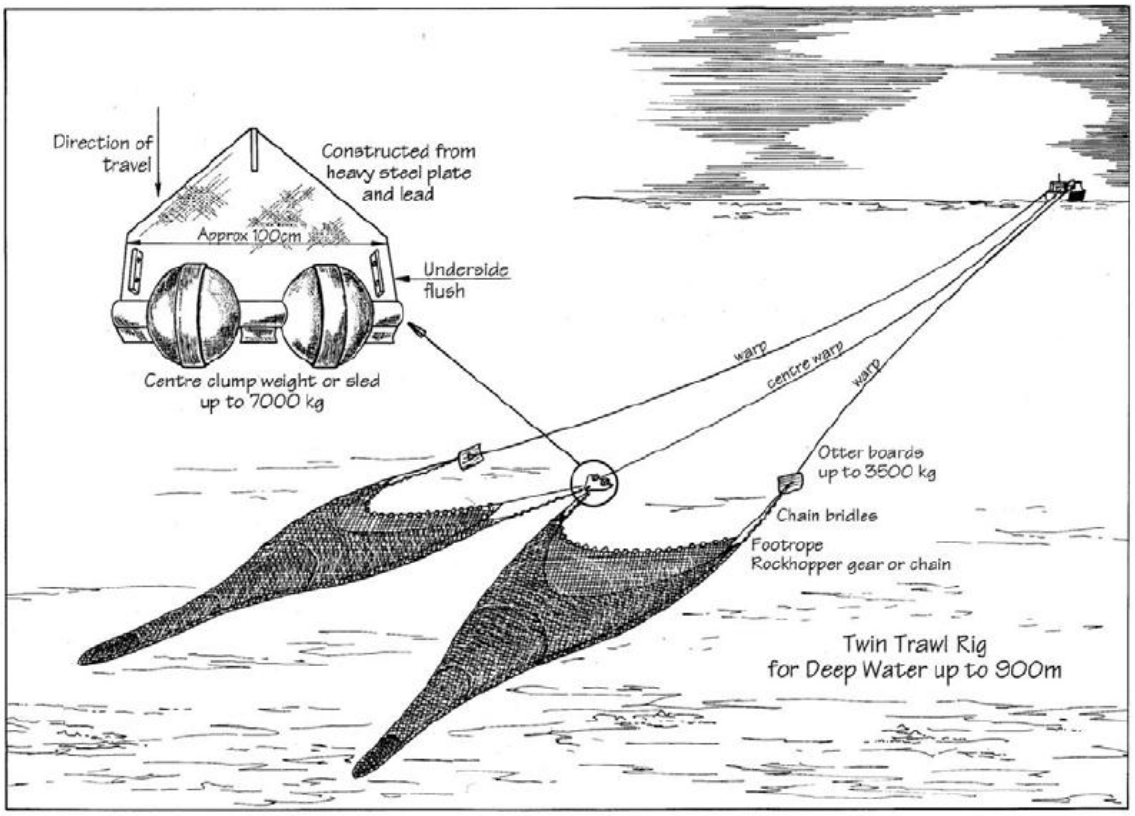

Figure 8.2 Twin Demersal Otter Trawl (Ref. iii)

The main components of an Otter Trawl that have the potential to hook a subsea cable are the trawl doors and the clump weight.

8.2.2 Beam Trawl

The Beam Trawl is a bottom fishing trawl net, used mainly for catching demersal flatfish with the head rope attached to a beam towed along the bottom on runners at either end. The net is heavily weighted with a chain on the underside and has tickler chains running in front.

A schematic of a typical Beam trawler is present in Figure 8.3, below.

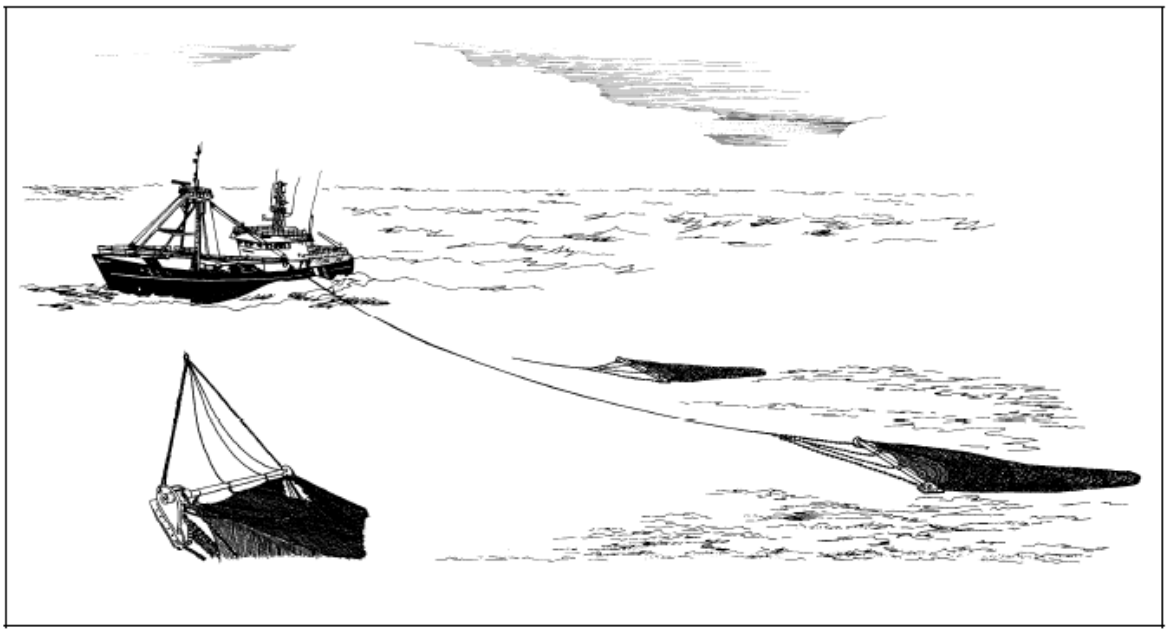

Figure 8.3 Beam Trawler (Ref. iii)

The main components of a Beam Trawl that have the potential to hook a pipeline are the beam and runners/shoes.

8.2.3 Scallop Dredger

Most Scallop Dredgers have a chain bag which drags along the bottom collecting the catch. Some also use steel teeth which penetrate the seabed for a few centimeters. Like other gear types, greater bottom penetration can occur under unusual conditions, such as when a dredge pushes a rock ahead of it.

A dredge 4.5m wide with tickler chains can weigh in excess of 2,200kg when empty. With towing speeds ranging up to five knots, this type of gear can easily damage a submarine cable. In some fisheries, deflecting bars and wheels have been added to help the gear pass over seabed obstacles. Such devices may also help prevent entanglement with cables.

An example of a typical Scallop Dredger is presented in Figure 8.4.

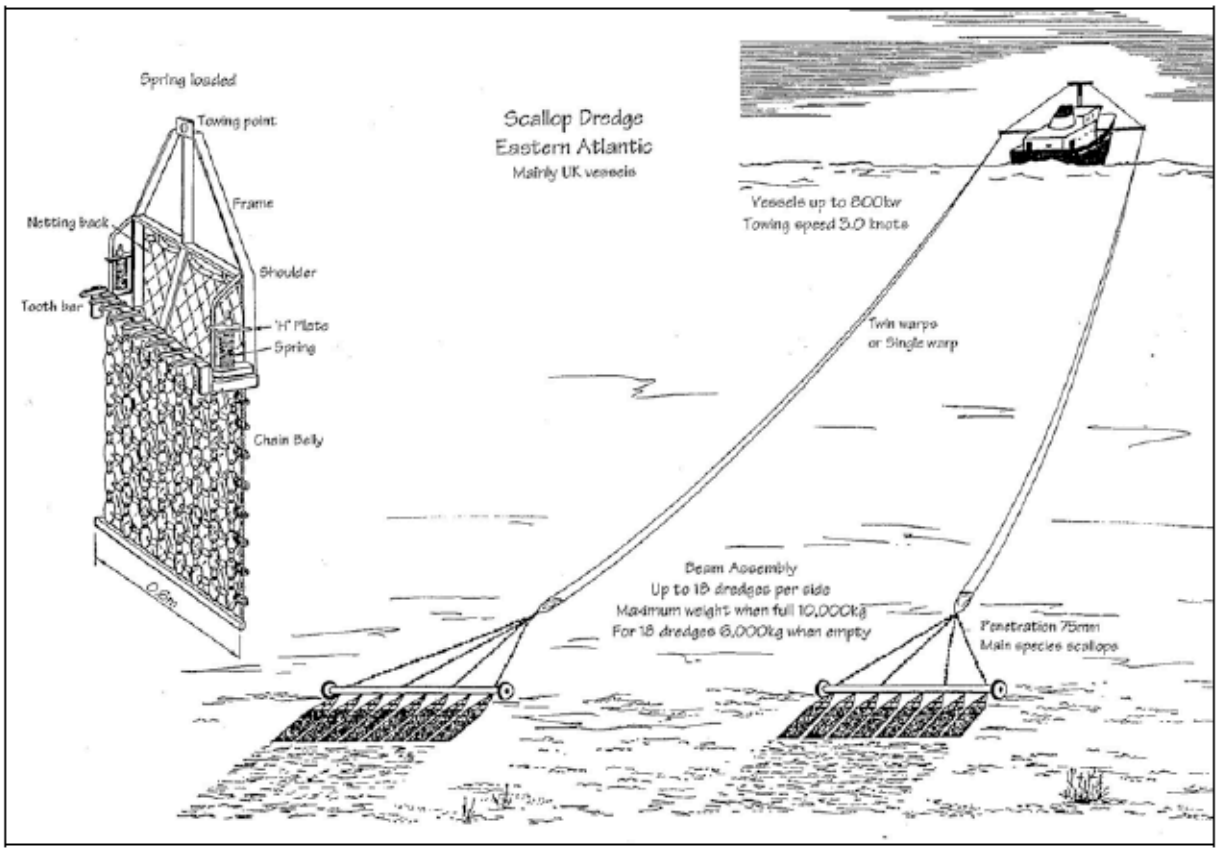

Figure 8.4 Plan View of Scallop Dredger (Ref. iii)

8.2.4 Gear Interaction with Cables

When trawl gear is towed over or along a cable the interaction can be considered in three phases at described below.

- Impact:
  - The initial phase when the trawl board, beam shoe or clump weight hits the cable. This impact occurs over a short time frame and mainly results in localised damage to the shell and protective coating of the cable. This stage has the potential to damage the cables but rarely damages the trawl gear and there is negligible risk to the fishermen on board the vessel.

- Pull over:
  - When a trawl board, beam trawl or clump weight is pulled over the cable. The duration of this phase is longer than that of the initial impact and forces can be significantly greater. Again the risks to fishermen during this phase of the interaction are limited.

- Hooking:
  - Hooking occurs when the trawl equipment becomes "stuck" under the cable. This tends to be a low probability event but it represents the greatest risk to fishermen.

8.3 Vessel Foundering

A foundering is considered to be when a vessel suffers structural failure and sinks. This type of an incident has the potential to damage a subsea cable if the vessel sinks over the cable.

It is noted that this type of an incident is considered to be a very low frequency event based on historical incident data for the UK (from 1994-2008 approximately 4% of all MAIB incidents were flooding/foundering).

8.4 Dropped Object

A dropped object could arise during transfer operations in port, at an offshore oil and gas installation (over-side lifting) or during lifting works from an offshore barge or construction jack-up.

Dropped objects from commercial vessels (e.g. container ships or Roll on-Roll off vessels (RO-ROs) are more likely to take place during adverse weather and heavier sea conditions (open sea environments). Many factors are likely to influence the potential damage caused to a subsea cable from a dropped object (e.g. type, size and velocity).

Military training areas could also pose a risk to a subsea cable due to firing of munitions from coastal ranges and marine based firing/bombing areas used by the Royal Navy and RAF.

8.5 Anchoring

Anchoring has the potential to damage a subsea cable if a vessel drops anchor or drags anchor over the cable. The damage caused depends on the penetration depth of the anchor (which depends on vessel size and type of anchor), the type of seabed and depth to which the cable is buried.

It is considered that anchor interaction with a subsea cable will be similar to that of fishing gear interaction, based on impact, pull over and potential snagging phases.

Anchoring can take place for a number of reasons. The following scenarios are likely to lead to a vessel anchoring:

- Adverse weather anchoring (e.g. in a safe haven, sheltering in severe weather);
- Anchor dragging (e.g. adverse weather impacting a vessel at anchor or when a vessel drops anchor for emergency reasons – collision or drifting)
- Machinery failure (e.g. to slow drift speed/stop and/or to carry out repairs);
- Waiting on orders (e.g. commercial vessels and/or drilling rigs);
- Waiting on approach to a port (e.g. port berth or pilotage); and
- Subsea operations/survey vessel and semi-submersible drilling rig anchoring.

Vessels that were involved in machinery failure incidents (e.g. fouled propeller, sail failure, out of fuel or engine breakdown) can drop anchor to reduce drift speed (not under command).

9. SHIPPING AND NAVIGATION IMPACT REVIEW

9.1 Introduction

Following the baseline shipping and high level hazard review, an assessment of the impacts of installing offshore export cable routes from the proposed wind farms to shore are assessed.

9.2 Commercial Shipping

Impacts on commercial shipping from the offshore export cable route are assessed in the following subsections.

9.2.1 Impact on Commercial Ship Routing

The main shipping route intersecting the offshore export cable routes was traffic headed north and south, 2.5nm east of Rattray Head (including roll-on/roll-off vessels, cargo ships and ferries headed to the Northern Isles from Aberdeen). Cargo vessels and tankers (including fishing vessels) also cross the cable routes on a well-defined route heading north by north west and south by south east associated with the traffic to/from the Pentland Firth.

There is a lower use route recorded between 3-7nm of the coast, north of Fraserburgh, passing east to west into the Moray Firth. This route is largely composed of small to medium coastal cargo ships (approximately 3nm from Kinnaird Head) and shuttle tankers routing in deeper water (approximately 6.4nm from shore).

Offshore supply vessels also intersect the offshore export cable routes, to the north and east of Fraserburgh. Vessels are generally supporting mobile/temporary drilling operations and fixed offshore platforms in the area, including Ross Field (18.3nm north east of the shared corridor), Captain Field (23nm north east of the shared corridor) and Beatrice/Jacky Fields (11 to 19nm south west of the shared route).

In general, shipping in the area of the two cable routes keeps in the order of at least 1 to 2.5nm north and east of the Aberdeenshire coast. This distance means commercial shipping is well clear of shallower areas where there could be the possibility of a vessel grounding or foundering on the export cable. A number of coastal vessels were recorded passing closer to shore (dependant on draught and sea conditions), however in general commercial vessels avoid inshore areas unless they are seeking an anchorage (Section 9.2.2).

The Fraserburgh Bay cable route intersects the Fraserburgh port approaches. However, the vast majority of vessels using this port are fishing vessels, and given the proximity of the cable landfall to the port, commercial vessels should be attentive to navigational hazards as they approach and/or depart the harbour.

Given the available sea room to the east and west of the of the offshore export cable routes and the low levels of inshore commercial vessels in close proximity to the Fraserburgh Bay and Rattray Head cable landfalls, there will be minor impact on commercial ship routing. The main impacts will be of a temporary nature during the cable laying/installation process.

9.2.2 Impact on Anchoring

A Navigational Hazard Review Workshop, carried out in July 2011, as part of the NRA for

the offshore wind farm developments within the Moray Firth. The workshop highlighted that the Moray Firth provides vessels with sheltered anchorages, inshore of adverse sea and weather conditions that can be experienced in the North Sea. Vessels including, shuttle tankers, offshore supply ships, military vessels, survey and cable laying vessels anchor off the Moray Firth coastline during severe weather.

Anchoring within 10nm of the offshore export cable routes was recorded in Aberdour Bay (7.3nm west of the Fraserburgh cable route) and north of the Southern Trench (5-6nm west by south west of the shared cable route). In both these areas, the sea bed type is sandy gravel where there is good holding ground for anchoring.

Smaller vessels were recorded using the inshore anchorage at Aberdour Bay (offshore supply vessels and small-medium sized cargo ships), with large crude oil and shuttle tankers recorded north of the Southern Trench. A large crude oil tanker was also recorded 5nm west of the Fraserburgh Bay route, in sand/muddy sand sea bed type, which is considered to be highly mobile (in terms of sea bed mobility).

Sea bed mobility is relatively high within and adjacent to the Southern Trench and 7nm north of Fraserburgh Bay, therefore to minimise the risk of export cables becoming exposed to anchor interaction, alternative forms of cable protection should be considered (i.e. mattresses and rock dumps), as well as regular surveys to monitor cable burial depths.

There is a charted anchorage in Fraserburgh Bay and two vessels were recorded at anchor within the cable route during the shipping survey. It is expected that following installation of the export cables and marking on admiralty charts, anchoring activity in Fraserburgh Bay is likely to migrate, as vessels become aware of the subsea cables. Kinnaird Head is approximately 1nm west of the Fraserburgh Bay cable route, and there is a sandy gravel sea bed which covers the sea area to Aberdour Bay, which offers vessels shelter and good holding.

In terms of the Rattray Head route, the impact on anchoring should be lower given the limited anchoring recorded in the area. One vessel was recorded at anchor within Strathbeg Bay during the survey, approximately 1nm west of the Rattray Head route.

The risk of anchor interaction for both export cable routes is considered to be higher for the Fraserburgh Bay route, therefore, to minimise the impact on current anchoring practices, cable protection and burial should be explored to decrease the likelihood of anchor dragging or snagging cables.

Overall, given the low number of vessels anchoring in close proximity to the cable routes, the impact on anchoring is considered to be minor assuming industry standard mitigation and cable burial/protection.

9.2.3 Impact of Increased Traffic (cable laying and marine operations vessels) on Commercial Ship Routes

The presence of cable laying vessels within the offshore export cable routes can pose additional risk to navigation. This is mainly due to increased vessel activity and the fact that cable laying vessels are restricted in manoeuvrability. This may lead to an increase in ship-to-ship encounters in the area as passing shipping deviates around cable laying works.

There is a relatively low density of commercial vessels in the area (the majority of vessels recorded in close proximity to the cable corridors were fishing vessels on passage). Therefore, there is available sea room for passing vessels to route around additional marine operations traffic and cable laying vessels operating in this area.

Assuming industry standard mitigation and Safety Management Systems (SMS), it is expected that cable laying works can be carried out safely, with a minor impact on shipping and navigation.

9.3 Impact on Fishing Vessels

Impacts on fishing vessels from the offshore export cable routes are assessed in the following subsections.

9.3.1 Impact on Fishing Vessel Routing

The shipping survey (July to October 2011), recorded a relatively high density of fishing vessels on passage, approximately 2nm from Rattray Head. A large portion of vessels were also recorded on passage to Fraserburgh, intersecting the Fraserburgh Bay route, with inshore fishing vessel vessels (associated with Peterhead) intersecting the Rattray Head cable route.

Local fishing vessels will be aware of construction works and cable laying vessels within the offshore export cable routes through Notices to Mariners (NtMs) and fisheries liaison. Non-local fishing vessels will become aware of the cable laying activities as they arrive at fishing grounds through day marks and lights used by the cable laying vessels to advise passing vessels of restrictions in manoeuvrability.

Given the available sea room east and west of the cable routes and the relatively small size and draught of fishing vessels (mean length of 21m and mean draught 2.4m), there will be a minor impact on routing during the cable installation phase of the work.

9.3.2 Fishing Gear interaction

In terms of fishing gear interaction, areas of demersal trawling and scallop dredging were recorded within and adjacent to the shared offshore export cable route (8-10nm north of Southern Trench). Scallop dredgers have a chain bag which drags along the sea bed collecting the catch.

Sea bed penetration depth of dredging gear varies (based on gear type/ weight and sea bed type); however, penetration depths up-to 75cm have been recorded. Therefore scallop dredgers are at higher risk of gear interaction with the export cables. The cable route area north of the Southern Trench is likely to require burial, trenching or alternative forms of protection (i.e. mattresses and rock-dumping). Cable protection and burial will reduce the impact on fishing vessels, as well as protect the cable. Overall, the risk to scallop dredgers operating in the vicinity of the offshore export cable route, north of the Southern Trench is considered to be moderate.

However, within, the shared cable corridor, fishing satellite data (2009), indicated that 67% of fishing vessels were steaming as opposed to engaged in fishing (i.e. gear deployed). The baseline data for the Fraserburgh Bay route also showed that there is a high density of fishing vessels steaming over the proposed route, on approach and departure from Fraserburgh port.

A low density area of fishing activity (over flight surveillance, 2005-09 and satellite monitoring, 2009) was recorded off the Rattray Head route; however most sightings and AIS tracks were vessels steaming, as apposed to fishing in the area.

There is a risk to fishing vessels should they snag their gear on unprotected cables or cables running over spans (8-10nm north of Southern Trench). However, with cable protection/burial as well as survey/monitoring (given the sea bed mobility) and liaison with the fishing industry, it is considered, that export cable works will have a minor impact on fishing vessels.

9.4 Impact on Recreation Vessels

The offshore export cable route is intersected by two medium, and two light use RYA/CA cruising routes headed into the Moray Firth and offshore to the Northern Isle. In addition, during the survey a number of recreational vessels were recorded sailing from Peterhead, off Rattray and Kinnaird Head, within approximately 1 to 2nm of the coast.

Overall, a minor impact is predicted on recreation vessel routing, given available the sea room and assuming works are safely managed using Safety Management Systems (SMS).

9.5 Impact on Small Vessel Anchoring

The impact on smaller vessel anchoring, including fishing and recreational vessels is expected to be similar in nature and extent to those discussed for commercial shipping anchoring impacts. However, small vessels are likely to seek more sheltered/inshore anchorages, which are not limited by sea depth and anchor chain length.

Consultation carried out with RYA and CA during the NRA (for wind farm and export cable works) stated that consultees would like the export cables buried, particularly near port approaches (e.g. the Fraserburgh Bay corridor). However, RYA/CA noted this is not considered an issue where sea depth is less than 10m (approximately 900m north of the Fraserburgh Bay cable route landfall).

Assuming industry standard mitigation/cable burial and surveys to monitor export cables, a minor level impact is predicted on smaller vessel anchoring.

9.6 Electromagnetic Interference on Navigation Equipment

An additional navigational impact was identified based on electromagnetic interference on small vessels (mainly recreational craft and small fishing boats) navigation equipment including compasses and communication equipment.

The offshore export cables from the three proposed wind farms are proposed to be High Voltage Direct Current (HVDC), given the ability to transmit large amounts of power over long distances with lower costs and reduced power losses compared to Alternating Current (AC). However, HVDC export cables could cause deflection of a compass needle through electromagnetic interference. In addition, some vessels use an auto-pilot which is reliant on a magnetic sensor and may experience slight steering issues if crossing a HVDC cable.

However, based on the findings of the trials at the North Hoyle Offshore Wind Farm (Ref. iv), the wind farm generators and their cabling, inter-turbine and onshore, did not cause any

compass deviation during the trials. In addition studies have found that the greater distance the compass is from the cause of interference the less impact will be experienced.

It is assumed that all equipment and offshore export cables from the three proposed wind farms will be rated and in compliance with design codes. In addition the export cables will be buried (where possible) and any generated electromagnetic fields will be very weak and will have a minimal impact on navigation or electronic equipment.

10. RISK MITIGATION AND MONITORING

10.1 Introduction

This section summarises the main mitigation measures and monitoring procedures which could be established for the offshore export cables.

10.2 Mitigation

The following risk mitigation measures can be used to protect subsea cables from hostile interaction, (i.e. dropped object, anchor and fishing gear interactions):

- Routing cables away from fishing grounds.
- Routing cables on stable and even ground to limit free spans.
- Trenching cables.
- Use of rock dumping to cover cables or to limit the height of free spans.
- Use of concrete mattresses to cover cables so they are more over trawlable.
- Circulating information on cables to the fishing community, e.g. fishing liaison and FISHSAFE via Kingfisher Information Services-Cable Awareness (KIS-CA).
- Vessels setting up anchoring alarm zones to warn if an anchor has moved (dragged).
- Circulating information on cables to other marine stakeholders, e.g. local ports, recreation sailing clubs, ship operators and the Defence Infrastructure Organisation.
- Cables routes are charted on United Kingdom Hydrographic Office (UKHO) admiralty charts and potential no anchorage zones shown over cables.
- Monitoring of cable route from Marine Operations/Coordination centre with system set up to alarm when vessels show reduced speeds in proximity to the cable route.
- Periodic and planned surveys of cable routes to monitor burial depths and sea bed mobility.

Prior to construction, Notices to Mariners (NtMs), Very High Frequency (VHF) broadcasts and guard vessels (if necessary) should be considered. Safety Management Systems (SMS) will also be in place by vessel operators.

Cables should be buried to taking into account sea bed type, fishing and anchoring practices in Moray Firth. Positions of cable routes notified to Kingfisher Information Services-Cable Awareness (KIS-CA) for inclusion in cable awareness charts and plotters for the fishing industry.

Local workshops on shipping and navigation issues have taken place discussing local issues. Consultation should also continue both pre- and post-construction and during the life of the project with the MCA and other relevant stakeholders including offshore operators at the Beatrice and Jacky Oil Fields.

10.3 Future Monitoring

From a navigation risk perspective, monitoring will take place through the project's SMS.

The subsea cable routes will be subject to periodic inspection to ensure they remain buried. Any future maintenance works on the cable route should be carried out following issuing NtMs, broadcasts on VHF and use of guard vessels (if necessary).

11. CONCLUSIONS

The hazards associated with the proposed offshore export cable routes were assessed.

The Moray Firth provides vessels with anchorages that are sheltered from adverse sea/weather conditions. Anchoring within 10nm of the offshore export cable routes was recorded in Aberdour Bay (mostly smaller vessels) and north of the Southern Trench (crude oil and shuttle tankers).

In terms of anchor interaction, the Fraserburgh Bay route is considered to be higher risk than the Rattray Head route, as there is a charted anchorage within Fraserburgh Bay. However, given the low number of anchoring vessels the overall impact is considered to be minor.

There is the potential for hostile gear and anchor interaction (Fraserburgh Bay and in areas of scallop dredger north of the Southern Trench), therefore an anchor penetration study and Burial Protection Index (BPI) assessment should be carried out to further assess cable protection methods for these areas of the cable route.

In terms of the impact on shipping and navigation, given the relatively low level of commercial shipping activity along the majority of the cable routes, and the available sea room east and west, vessels should be able to increase passing distance from cable laying vessels and associated works.

There is a risk to fishing vessels due to gear snagging on unprotected cables, as demersal trawling and scallop dredging were recorded in the combined cable route, north of Southern Trench. However with cable protection/burial, monitoring of cable burial depths and liaison with the fishing industry, the impacts on fishing vessels are considered to be minor.

The electromagnetic fields generated by the HVDC export cables are likely to be very weak and the impact on navigation equipment is considered to be minor.

12. REFERENCES

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